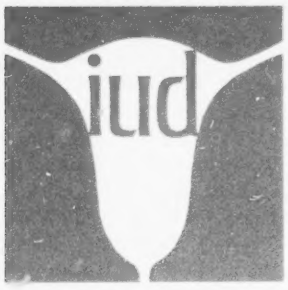
02520-1.4



Population Reports

Series B
Number 3
May 1979

INTRAUTERINE DEVICES

Population Information Program, The Johns Hopkins University, Hampton House, 624 North Broadway, Baltimore, Maryland 21205, USA

IUDs — Update on Safety, Effectiveness, and Research

Summary. After nearly two decades of use, the IUD remains "a generally safe, effective and useful form of birth control" (337). With fewer than six pregnancies per 100 woman-years of use and fewer than ten deaths per one million woman-years of use, according to a comprehensive new review by the United States Food and Drug Administration, the IUD has an important place in modern family planning programs.

The number of women using IUDs is growing slowly but steadily. Most extensive use is in the People's Republic of China, where visitors have been told that half or more of all those using contraception have accepted IUDs. In Korea and Taiwan, where successful programs have been underway since the mid-1960s, the IUD is also the principal method. In about a dozen other developing countries more than 5 percent of all married women of reproductive age use IUDs. In Europe IUD use ranges from less than 5 percent in Italy to as high as 20 percent in Scandinavian countries. In the USA about 6 percent of married women of reproductive age have IUDs. Worldwide, approximately 50 to 60 million devices may be in use, 40 million or more in China and 15 million in the rest of the world.

Nevertheless, despite extensive experience and continuing research in both developed and developing countries, some of the original problems of IUD use remain unresolved and some of the promising new solutions remain unproven. The basic problems of IUD use are:

- increased menstrual bleeding or spotting
- expulsion soon after insertion
- increased frequency of pelvic infection
- unwanted pregnancies that are more likely to be ectopic or to result in septic midtrimester abortion than pregnancies in nonusers

The promising new approaches that could minimize or eliminate some of these problems include:

- medicated devices that are effective up to 10 years
- medicated devices with compounds to reduce bleeding
- devices designed to reduce expulsion after early postpartum and postabortion insertion
- improved fit of IUD size and configuration to the uterus
- better insertion techniques and instrumentation

Experience with the IUD throughout the world has demonstrated that within certain limits clinical and individual factors may have more impact on continuing IUD use than the design of the device itself. The skill of the health personnel, whether physician, midwife, or other auxiliary, and the care and follow-up provided may produce more satisfied users than does the latest permutation of device. With this recognition, attention is now focusing on specific techniques of insertion, training of personnel, and conscientious follow-up. The result has been improved performance over the years with the first generation of IUDs, especially the Lippes Loop, which for the last decade has been the standard device against which others were measured.

To ensure best results, proper insertion is crucial. The IUD must be inserted gently and high into the uterine fundus. New measuring devices may well facilitate selection and precise placement of the right size of device. For postpartum use, a longer inserter or even hand insertion may be most effective. The withdrawal technique of insertion, in which the inserter is placed in position, the IUD released, and the inserter then withdrawn from the uterus, results in fewer perforations than the original technique of pushing the device out of the inserter. Many clinicians find the T- and 7-shaped devices easier to insert than the more complex configurations with a larger surface area.

In the past IUD insertion was often limited to the time during and immediately after menstruation or more than eight weeks after delivery. Now, even though many centers still follow these traditional patterns, data show that IUDs can be safely inserted at any time (including immediately after abortion) provided the woman is reasonably sure she is not pregnant. Unless there are specific medical contraindications, IUDs can be inserted at the convenience of the woman.

CONTENTS

History B-51
Distribution and Usage B-52
Safety and Effectiveness B-56
Insertion and Removal B-59
Expulsion B-62
Perforation and Embedding B-63
Bleeding and Pain B-64
Infection B-67
Pregnancy B-69
Guidelines for Use of IUDs B-74
Evaluation and Research B-77
IUD Photographs and Information B-86
Bibliography B-94

This issue of **Population Reports** was prepared by Phyllis T. Piotrow, Ph.D., Ward Rinehart, and John C. Schmidt of the Population Information Program on the basis of published and unpublished materials, correspondence, and interviews. Comments and additional material are welcome.

The assistance of the following reviewers is appreciated: L.P. Chow, Elizabeth B. Connell, Gordon Duncan, David Edelman, Henry Elkins, Henry Gabelnick, A.T. Gregoire, Paul A. Harper, James R. Heiby, John F. Kantner, Theodore M. King, Leonard E. Laufe, Daniel R. Mishell, Jr., Dorothy Nortman, Howard Ory, Bruce Pharriss, Allan Rosenfield, Marschal Rothe, Patrick J. Rowe, James D. Shelton, Irving Sivin, Robert Snowden, J. Joseph Speidel, Bruce Stadel, William Sweeney, Howard Tatum, Carl Taylor, Robert Wheeler, Jack Lippes, Dean L. Moyer, and Malcolm Potts.

Population Reports (USPS 063-150) is published bimonthly (January, March, May, July, September, November) at 624 North Broadway, Baltimore, Maryland 21205, USA, by the Population Information Program of the Johns Hopkins University and is supported by the United States Agency for International Development. Second class postage paid at Baltimore, Maryland, and additional offices. Postmaster to send address changes to **Population Reports**, Population Information Program, The Johns Hopkins University, 624 North Broadway, Baltimore, Maryland 21205, USA.

Population Reports is designed to provide an accurate and authoritative overview of important developments in the population field. It does not represent official statements of policy by the Johns Hopkins University or the US Agency for International Development.

Phyllis T. Piotrow, Ph.D., Director; Helen K. Kolbe, M.S., Co-Director; Ward Rinehart, Editor.

Good clinical management includes counseling the IUD user, explaining potential problems clearly, and providing sympathetic management both of immediate postinsertion complications and of long-term side effects. (A summary guide for clinicians that can be detached and displayed on the wall is included on pages B-74–B-75.)

A second generation of IUDs contains pharmacologically active substances such as metallic copper or progestational steroids that are released into the uterine cavity. The Cu-7 and the TCu-200 have been available for several years. Most studies show reduced bleeding and lower expulsion rates with copper devices, which are better tolerated by nulliparous women than inert IUDs. The Progestasert, which releases into the uterine cavity about 65 μg of progesterone a day over a period of one year, reduces menstrual bleeding but may be associated with more ectopic pregnancies. Three issues should be resolved before medicated devices are incorporated on a large scale into national programs: (1) what is the effective life of the devices before the active ingredient is exhausted? (2) what provision should be made for replacement if the contraceptive effect is diminished? and (3) what long-term toxicity and other adverse effects should be considered and/or disproved?

In addition to commercially available devices, other medicated IUDs are being used on an experimental basis. These include the Population Council's copper devices with 220 or 380 sq mm of copper surface area. They contain copper sleeves on the transverse bars of the T, where the copper reaches the uterine fundus more effectively and lasts longer, as well as on the vertical arm. Other experimental devices containing antifibrinolytic substances for release into the uterus to reduce bleeding directly are now being tested by the International Fertility Research Program. The World Health Organization's Special Programme of Research in Human Reproduction is testing a T device designed to release 2 μg a day of the progestin levonorgestrel for a minimum of five years with a substantially reduced menstrual blood loss. Because anemia is a serious problem for women in developing countries, any modification that could reduce bleeding without causing other problems would be extremely useful.

One variation that is being tested to reduce expulsions of devices inserted immediately after delivery or abortion is to affix short chromic sutures to the upper horizontal bar of the device. The chromic suture material, which is biodegradable and dissolves within a few weeks, helps to anchor the device, since the chromic projections make the device larger at the time of insertion and then temporarily embed in the uterus as the uterus returns to normal size.

Even as solutions are being proposed for bleeding and expulsion problems, however, new data suggest that the risk of infection which helped to discredit IUDs earlier in the century may still be significant. Higher rates of both diagnosed infection and asymptomatic inflammation have been found among IUD users, especially among young, sexually active women in the developed countries, where pelvic inflammatory disease (PID) is often a sexually transmitted disease. It is possible that PID may lead to infertility among older women. Moreover, when pregnancy occurs with an IUD in situ the risk of an ectopic pregnancy or a septic midterm abortion is higher than in nonusers. Roughly estimated, one in 30 pregnancies in IUD users is ectopic compared with one in 250 in large populations. Better protection against uterine than ectopic pregnancy for IUD users may explain this difference. Whether other mechanisms are also at work is not clear. The dangers of ectopic pregnancy, especially in developing countries where emergency surgical care is scarce, and the similarity of symptoms to IUD-related bleeding and pain require health care personnel to be especially alert to the possibility of ectopic pregnancy. Septic midtrimester abortions in women whose IUDs remained in place during pregnancy have lead to a small number of deaths reported in the US. Removing the device as soon as pregnancy is detected appears to reduce markedly the risk of this and other complications of uterine pregnancy.

With the IUD as with oral contraceptives, it is possible that widespread use and extensive research will identify more relatively rare but potentially serious complications. These must be viewed in the perspective of overall risks and benefits. In developing countries where maternal mortality may be 200 to 300 per 100,000 births, mortality from IUD use is estimated to be in the range of only 1 to 3 deaths annually per 100,000 users. In terms of mortality, IUDs are about twice as safe as oral contraceptives used by young women without conditions predisposing them to circulatory disease and three to five times safer than OCs used by older women. Thus the IUD is a safe and reasonable choice for individual women and for family planning programs.

HISTORY

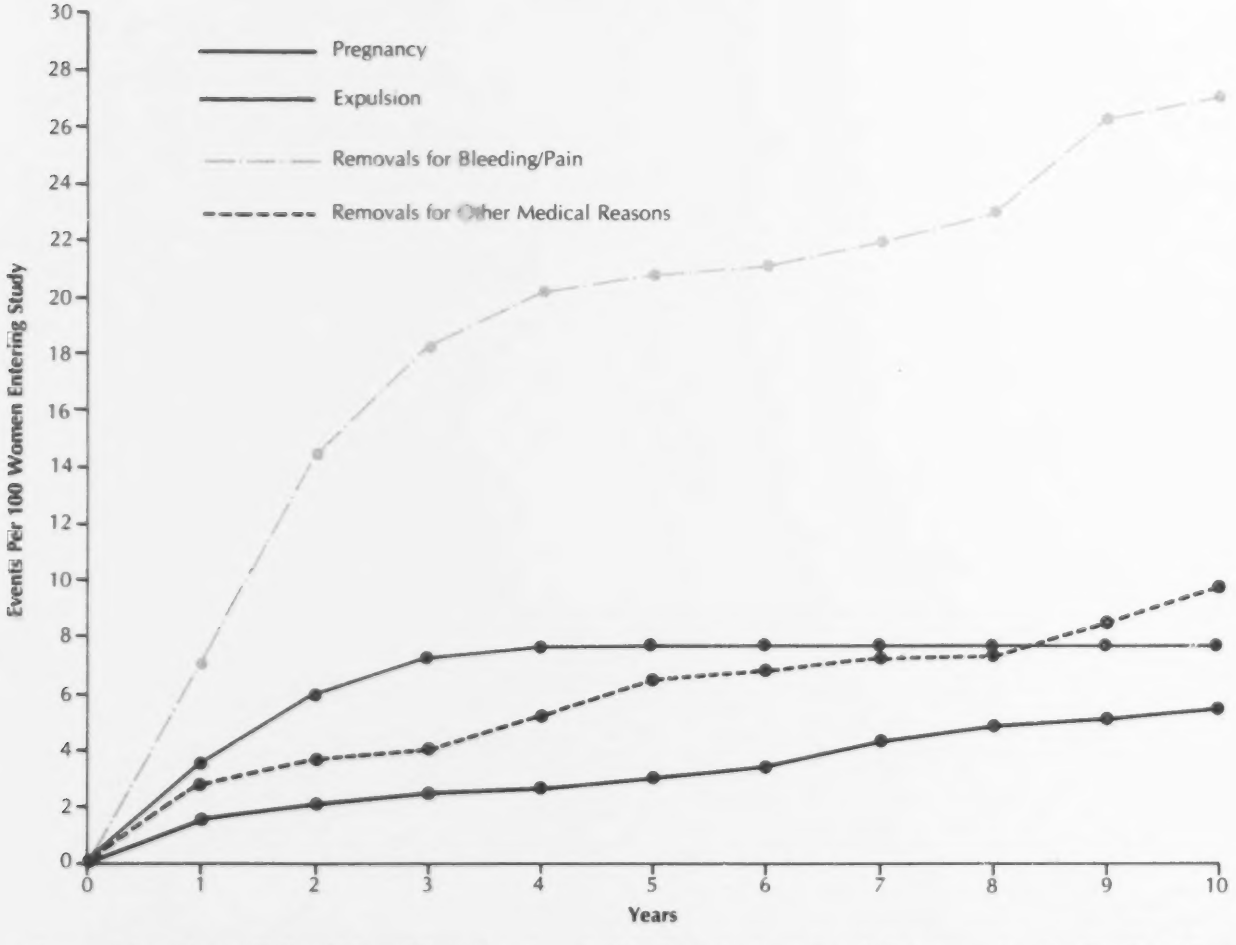
The millions of intrauterine devices in use throughout the world today represent the modern application of an ancient concept. The first IUDs may have been pebbles inserted into the uteri of camels by Arabs and Turks who wanted to protect their saddle animals from pregnancy during long desert treks (60,337). In humans, the use of contraceptive pessaries was reported in the 11th century by the Islamic scientist Avicenna. During the late 19th century, stem pessaries made from materials as common as pewter and as exotic as diamond-studded platinum were in use (290). These were technically not intrauterine devices since they did not rest entirely within the uterus; the bulk of the device remained in the vagina while the stem extended through the cervical canal and protruded into the uterine cavity. They were inserted to correct uterine position and induce abortion as well as to prevent pregnancy (60).

The first IUD designed solely for human contraception was developed in 1909 by a German physician, Richard Richter. The device was ring-shaped and made of silkworm gut (234). Silkworm threads were also incorporated in a cervico-uterine device developed in 1923 by K. Pust, who combined the silkworm ring with the older stem pessary (227). Pust reported no pregnancies or serious complications among 453 women in whom he inserted the device. He distributed his IUD to other physicians, but many refused to use it on the grounds that such a device would produce pelvic infection (269).

The first IUD to be widely used was a ring of gut and silver wire, developed by Ernst Gräfenberg (75), which became popular in Germany in the late 1920s. In 1934, Tenrei Ota of Japan introduced gold and gold-plated silver intrauterine rings which he claimed were more efficacious than Gräfenberg's device (210).

Although enthusiasm greeted both devices initially, it was soon replaced by skepticism and even condemnation that branded them ineffective and dangerous. In 1936 the Japanese govern-

Figure 1. Ten-year Cumulative Rates of Pregnancy, Expulsion, Removals for Bleeding/Pain, and Removals for Other Medical Reasons, Lippes Loops C and D
(net cumulative rates)



Ten years of experience with the widely used Lippes Loop shows that bleeding and pain are the principal reasons for discontinuation, followed by expulsion, other medical reasons, and pregnancy.

Source: Lippes (163)

ment prohibited their use. Gräfenberg was forced to abandon his ring because of opposition by European physicians. Before the development of antibiotics, physicians were reluctant to adopt any method that might increase the risk of pelvic infection.

The conservative medical attitude toward IUDs lasted until the late 1950s, when technological progress prompted a reappraisal. To stimulate an objective international evaluation of IUDs, the Population Council in 1962 convened the first international conference on IUDs in New York. Physicians from the United States, Israel, Germany, and other countries reported favorable experience with IUDs (324).

In addition to advances in antibiotic therapy, which dispelled fears of uncontrollable infection, the technological factor that was crucial to acceptance of IUDs was the development of polyethylene, a biologically inert plastic that could be molded into any desired configuration and would return to that configuration after being bent or straightened. The Margulies Coil and the Lippes Loop were the first widely used plastic IUDs. Both could usually be inserted without cervical dilatation. They were first placed in a straight, narrow tube and then extruded into the uterus, where they resumed their original shape. Jack Lippes, of the US, added two important features to the device that bears his name, both of which most subsequently developed IUDs have incorporated: a transcervical thread to assist in detecting and removing the device and a small amount of barium sulfate to render the device opaque to x-rays (161).

Following the 1962 conference, the Population Council established the Cooperative Statistical Program (CSP) to undertake a broad evaluation of IUDs and, in 1964, held a second conference (264). Under the direction of Christopher Tietze, the CSP studied several types of IUDs, including Lippes Loops A, B, C, and D, the Margulies Spiral, large and small Birnberg bows, steel rings, double coils, and several others. This international evaluation involved some 27,000 insertions and over 39,000 woman-years of use. In order to compare the efficacy and safety of different devices studied over various time periods, investigators adopted life table analysis, an actuarial technique that measures the rates of critical events — pregnancies, expulsions, and removals — at various intervals after insertion. Life table rates are often expressed as, for example, the number of pregnancies, expulsions, or removals per 100 women at one, two, or three years of use (276, 323).

Tietze's evaluation demonstrated that the IUD was a safe and effective method of contraception appropriate for use in national family planning programs, many of which were being initiated at that time (322). He concluded that:

> No single type of IUD has consistently lower rates than the others for all types of events (pregnancies, expulsions, and removals), nor does any one IUD have consistently higher rates than the others (323).

By the mid-1970s, following a decade of continuing research on IUD design and worldwide experience with IUDs in national family planning programs, two major reviews of IUD development took place, a workshop sponsored by the Battelle Memorial Institute in Seattle in October 1973 (361) and a third international conference sponsored by the Population Council in Cairo in April 1974 (106). At both sessions, the focus of attention on IUDs was shifting to a so-called second generation of devices. These were the bioactive or medicated devices, in which the plastic IUD became a carrier for other substances such as metals, hormones, and antibleeding agents. (Originally "inert" and "bioactive," the preferred terminology has since become "unmedicated" and "medicated." All IUDs are recognized to stimulate a local reaction.) Earlier work had clearly shown that the larger devices, while reasonably effective in preventing pregnancy and resisting expulsion, had high removal rates for bleeding and pain (45, 267). Small devices, on the other hand, were easier to insert, created less bleeding and pain, but produced higher pregnancy and expulsion rates (310).

In the first medicated devices, developed by Jaime Zipper and Howard Tatum, copper wire was wrapped around the T or 7 devices, which had a relatively small surface area, to improve their contraceptive efficacy (302, 317, 383). Shortly thereafter, hormones were incorporated in various devices in order to deliver some of the same steroids which had proved effective in oral contraceptives directly to the uterus in much smaller doses. Somewhat later, other compounds designed to reduce the heavy menstrual bleeding associated with IUDs were also incorporated in different IUDs. Meanwhile research continued on different configurations of IUDs that would be more suitable for nulliparas, provide better protection against pregnancy, resist expulsion, and minimize other complications in case of perforation or accidental pregnancy.

The course of IUD development is not complete. But in two decades an ancient concept has been reactivated, improved by modern technology, subjected to international clinical scrutiny, and, despite acknowledged shortcomings, now finds an important place in modern contraceptive practice and in national family planning programs.

DISTRIBUTION AND USAGE

The IUD has proved a useful addition to family planning programs in developed and developing countries. For the individual user, the IUD offers the advantages of a relatively safe, effective, and convenient method that does not require repetition and does not interfere with sexual activity. For the family planning program administrator, plastic IUDs can be locally manufactured, inexpensively purchased, easily shipped and stored, and can be inserted by trained paramedical personnel (see p. B-61). IUDs, like other contraceptives, are provided free of charge for programs by a number of government, private, and international agencies.

Figures on IUD usage are difficult to gather since devices are made by many different manufacturers and distributed both through private physicians and public clinics. In developed countries, the most accurate estimates of current use are derived from national surveys, but these are often confined to ever-married or currently married women of specified ages or to other specific groups. In the industrialized countries, IUD use is highest in Finland and Sweden, with about 20 percent of married women of reproductive age using various devices; in France, Japan, and Denmark, with 7 to 9 percent; and in the US and Britain, with about 6 percent (1, 62, 200) (see Table 1).

In the US, surveys show that IUD use grew from less than 0.7 percent of married women of reproductive age in 1965 to 6.7 percent in 1973 and then declined to 6.1 percent in 1976 (62), perhaps as a result of adverse publicity on septic abortions (see

Table 1. Estimated Percentage of Married Women of Reproductive Age Using Intrauterine Devices in Selected Developed Countries, 1974-1978

Country	Ref. No.	Date	Percent of MWRA All Methods[1]	Percent of MWRA IUD
Belgium[2]	1	1975-76	87	3
Denmark[3]	1	1977-78	92	8
England & Wales	1	1975	76	6
Finland	253	1975-78	NA	20
France	153	1978	67	9.1
Hungary	200	1974	75	2
Italy	1	1976-77	NA	3
Japan[3]	190	1977	60	7
Netherlands	200	1975	71	4
Sweden	1	1977	75	19
United States	62	1976	69	6.1

[1]Including sterilization
[2]Dutch-speaking population only
[3]Contraceptive method last used, not necessarily currently in use

p. B-69). In Europe, IUD use is thought to be increasing (354). Among the nearly 2 million US users, as Table 2 shows, the Lippes Loop is most widely used, followed by the Cu-7, Dalkon Shield, and Saf-T-Coil (62).

Developing Countries

In developing countries IUDs are manufactured locally, sometimes on license from larger manufacturers, or in many cases provided by donor agencies, both public and private, such as the US Agency for International Development (USAID), the UN Fund for Population Activities (UNFPA) through the UN Children's Fund (UNICEF) and the World Health Organization (WHO), the Swedish International Development Authority (SIDA), the International Planned Parenthood Federation (IPPF), the Population Council, Family Planning International Assistance (FPIA), and the Pathfinder Fund.

For the last decade, the major provider of IUDs, either directly to other governments or indirectly through private agencies, has been USAID. A total of more than 9 million devices, almost entirely Lippes Loops, has been provided since 1968. Approximately 632,000 were delivered in 1978, down from the peak of 1.4 million in 1973 (see Table 3, p. B-90). USAID is planning to provide copper-clad devices for the first time in late 1979. IPPF has been distributing copper T devices since 1976 and

Table 2. Use of IUDs by Ever-married Women in the United States, by Marital Status and Type of IUD, 1976

Marital status	Number of women in thousands	Type of IUD: Lippes Loop	Saf-T-Coil	Cu-7	Dalkon Shield	Other
Currently married	1,582	35.2	13.1	30.2	15.3	6.2
Widowed, divorced, or separated	311	48.5	15.8	24.6	8.8	2.2

Source: Ford (62)

Table 7. Percentage of Married Women of Reproductive Age* Using Intrauterine Devices in Selected Developing Countries, as Reported in World Fertility Surveys, 1974-1976

Country	Date	Percent of MWRA All Methods	Percent of MWRA IUD
ASIA			
Fiji	1974	40	5
Korea, South	1974	35	8
Malaysia	1974	33	1
Nepal	1976	2	0
Pakistan	1975	5	1
Sri Lanka	1975	33	5
Thailand	1975	33	6
WESTERN HEMISPHERE			
Colombia	1976	42	8
Costa Rica*	1976	6	5
Dominican Republic	1975	31	3
Panama*	1976	54	4

*Aged 15-44, except in Costa Rica and Panama, 20-49

Source: Adapted from **Population Reports,** Series A, Number 5 (235)

will supply more than 150,000 in 1979, the majority of them to family planning associations in Chile and Colombia (78).

The UNFPA is also funding the purchase of an increasing number of IUDs for developing country programs, with the actual procurement undertaken by UNICEF (about 97 percent) and WHO (about 3 percent). Between 1974 and 1978, UNFPA has funded purchases (or shipments from the stockpile) of nearly 5 million IUDs for UNICEF and WHO, of which about 1.8 million were in 1978 (see Tables 4 and 5, p. B-91). These were primarily Lippes Loops and TCu-200s (19).

The Swedish International Development Authority has provided nearly 5 million IUDs to developing countries since 1967 (see Table 6, p. B-92). Of these, 3 million Dana Super devices, made in Czechoslovakia (see Figure 22, B-89), were sent to Vietnam; about one million, mainly Lippes Loops, to Sri Lanka; almost 700,000, mainly Lippes Loops, to Cuba; and 250,000, also mainly Lippes Loops, to Kenya. About half the shipments were made in 1977 (304).

The best estimates of IUD usage in developing countries come from the World Fertility Survey, but they are not available for most countries yet. Table 7 shows that, of the countries with data available, South Korea and Colombia have the highest IUD usage rates — 8 percent of married women of reproductive age — followed by Thailand with 6 percent, and Fiji, Sri Lanka, and Costa Rica with 5 percent. Other estimates by USAID and the Population Council suggest that IUD prevalence may reach or exceed 5 percent in Egypt, Tunisia, Indonesia, Ecuador, Jamaica, Mexico, and Paraguay, as well. In Taiwan, the Population Council estimates, 32 percent of married women of reproductive age use IUDs (see Table 8). In the People's Republic of China, half or more of rural contraceptors may be using IUDs (41, 262).

Data on new acceptors from 22 national family planning programs provide a further indication of IUD use, but new acceptor data (see Table 9, p. B-92) are difficult to interpret because they do not reveal the number of continuing IUD users or the duration of use. Population Council figures, gathered from 1968 to the present, show an increase since 1974 in both the number and proportion of IUD acceptors in only one country, Kenya; IUD acceptors as percentages of total acceptors have declined since 1974 in 14 countries — Egypt, Morocco,

Table 8. Two Estimates of Number (in Thousands) and Percentage of Married Women of Reproductive Age (MWRA) Using All Methods of Contraception and Using Intrauterine Devices, by Source of Supply and Service in 36 Countries, Calculated by Population Council and US Agency for International Development, 1975-1978

	Population Council Data						USAID Data	
	Commercial Sector		Government Sector		All Sources		Organized Programs	
	No. of Users	% of MWRA	No. of Users	% of MWRA	No. of Users	% of MWRA	No. of Users	% of MWRA
AFRICA								
Egypt[1] 1975								
All Methods					1,085	21		
IUDs					**473**	**9**		
Ethiopia 1977								
All Methods							31.0	0.6
IUDs							**0.6**	**0.0**
Ghana 1977								
All Methods			42.1	2.1	42.1	2.1		
IUDs			**3.5**	**0.2**	**3.5**	**0.2**		
Kenya 1977								
All Methods							96.9	4.9
IUDs							**20.0**	**1.0**
Mauritius 1978								
All Methods	4.2	3.4	61.6	49.2	65.8	52.5		
IUDs			**1.9**	**1.5**	**1.9**	**1.5**		
Morocco[2] 1977								
All Methods							165.0	6.2
IUDs							**35.0**	**1.3**
Tunisia 1977								
All Methods			137	17.0			199.3	21.9
IUDs	**1.6**	**0.2**	**50**	**6.2**	**51.6**	**6.4**	**71.6**	**7.9**
Zaire 1977								
All Methods							12.2	0.3
IUDs							**2.6**	**0.1**
ASIA								
Afghanistan 1977								
All Methods							23.7	1.1
IUDs							**1.4**	**0.1**
Bangladesh 1977								
All Methods					1,600	8.9	1,716.6	12.8
IUDs					**191**	**1.1**	**127.2**	**0.9**
Fiji 1978								
All Methods	3	3	31	34	34	38		
IUDs			**5**	**5**	**5**	**5**		
Hong Kong 1978								
All Methods	164	32	234	45	398	77		
IUDs	**2**	**0.4**	**10**	**2**	**12**	**2**		
India[3] 1977								
All Methods			24,949	23.4			26,082.0	24.4
IUDs			**1,429**	**1.3**			**1,482.0**	**1.4**
Indonesia 1978								
All Methods			4,370	23.0			4,318.7	20.2
IUDs			**1,476**	**7.8**			**1,459.0**	**6.8**
Iran 1978								
All Methods	453	8.1	905	16.2	1,358	24.3		
IUDs			**126**	**2.3**	**126**	**2.3**		
Korea, Republic of 1977								
All Methods	1,035	21.7	1,059	22.2	2,094	43.9	1,440.2	28.2
IUDs	**48**	**1.0**	**453**	**9.5**	**501**	**10.5**	**179.0**	**3.5**
Malaysia 1977								
All Methods	140	9	420	27	560	36		
IUDs	**9**	**0.5**	**8**	**0.5**	**17**	**1**		
Nepal 1977								
All Methods							107.1	4.3
IUDs							**1.9**	**0.1**
Pakistan[4] 1975								
All Methods					780	6	1,760.6	14.5
IUDs							**190.4**	**1.6**
Philippines 1977								
All Methods			1,200	22.0	1,200	22.0	1,348.9	24.0
IUDs			**200**	**3.8**	**200**	**3.8**	**113.3**	**2.0**

Table 8 (Continued)

	Population Council Data						USAID Data	
	Commercial Sector		Government Sector		All Sources		Organized Programs	
	No. of Users	% of MWRA	No. of Users	% of MWRA	No. of Users	% of MWRA	No. of Users	% of MWRA
Singapore 1978								
All Methods	51	18	153	53	204	71	153.4	57.2
IUDs	**2**	**1**	**7**	**2**	**9**	**3**	**7.0**	**2.6**
Taiwan 1978								
All Methods	583	27	830	38	1,413	65		
IUDs	**207**	**9**	**501**	**23**	**708**	**32**		
Thailand[5] 1977								
All Methods					1,677	32.3	1,750.1	31.2
IUDs			**358**	**6.9**	**358**	**6.9**	**270.1**	**4.8**
WESTERN HEMISPHERE								
Colombia[2] 1977								
All Methods	698	22.5	810	26.1	1,508	48.6	892.0	33.6
IUDs			**312**	**10.1**	**312**	**10.1**	**349.3**	**13.2**
Costa Rica[2] 1976								
All Methods					78.8	33.7	112.0	48.5
IUDs					**8.1**	**3.5**	**9.0**	**3.9**
Dominican Republic 1978								
All Methods			133	12.8			140.7	23.7
IUDs			**15**	**1.4**			**14.9**	**2.5**
Ecuador 1975								
All Methods					51.7	6.3	96.2	12.0
IUDs					**26.9**	**3.3**	**40.2**	**5.0**
El Salvador 1976								
All Methods	26	3.1	61	7.3	87	10.4	176.4	27.6
IUDs	**2**	**0.2**	**11**	**1.3**	**13**	**1.5**	**19.2**	**3.0**
Guatemala 1977								
All Methods							66.9	7.6
IUDs							**8.3**	**0.9**
Haiti 1976								
All Methods					41	5	192.0	19.9
IUDs							**4.8**	**0.5**
Jamaica 1977								
All Methods							85.3	42.0
IUDs							**13.0**	**6.4**
Mexico[6] 1976								
All Methods	800	9	1,015	12	1,815	21		
IUDs	**90**	**1**	**645**	**7**	**735**	**8**		
Nicaragua 1977								
All Methods							62.2	22.5
IUDs							**12.0**	**4.3**
Panama[7] 1975								
All Methods					175	44	59.8	32.1
IUDs					**12**	**3**	**10.9**	**5.9**
Paraguay 1975								
All Methods					49	10	90.3	27.0
IUDs							**22.3**	**6.7**
Peru[2] 1977								
All Methods							19.3	1.0
IUDs							**7.4**	**0.4**
Total IUDs Column	**361.6** **(308.0)**[9]		**5,611.4** **(1,300.4)**[10]		**3,764.0**[8]		**4,472.4**	
Estimated Total Program Use							**5,772.8**[11]	

Note: Population Council data are for January of specified year unless otherwise noted; 1978 data unpublished. USAID data are for 4th quarter of 1977 unless otherwise noted.

[1]Egypt — USAID data based on 4th quarter 1976
[2]Morocco, Colombia, Costa Rica, Peru — USAID data for 2nd quarter 1977; PC, Costa Rica, women aged 20-49.
[3]India — PC data as of March 1977
[4]Pakistan — PC estimate based on 1975 Pakistan Fertility Survey; MWRA are aged 15-49.
[5]Thailand — PC estimate based on World Fertility Survey
[6]Mexico — PC data as of June 1976
[7]Panama — USAID data for 3rd quarter 1977
[8]India, Indonesia, Dominican Republic not included in column 5 (PC: All Sources)
[9]Excludes all countries included in column 7 (USAID: Organized Programs)
[10]Excludes countries for which USAID data are given in columns 7 and 8 (USAID: Organized Programs)
[11]Total USAID IUD users plus PC Government Section IUD users not included in column 7 (USAID: Organized Programs), i.e., 1,300.4

Source: Nortman and Hofstatter (203, 204) and USAID (330)

Tunisia, Afghanistan, Bangladesh, India, Iran, the Philippines, Taiwan, Thailand, Costa Rica, the Dominican Republic, Ecuador, and El Salvador — even though in some cases the actual number of new IUD acceptors has increased. This is because the use of other methods such as oral contraceptives and sterilization has increased even more rapidly (200-204).

China

If the data provided to visitors are accurate, the IUD is the major contraceptive method used in the People's Republic of China (32, 41, 233, 262). While provincial and national data on the prevalence of different contraceptive methods have not been released — if indeed they exist — several apparently knowledgeable officials have suggested that as many as 50 to 70 percent of Chinese contraceptors use IUDs. In a briefing given to members of the US-China People's Friendship Association National Medical Delegation on November 17, 1978, in Peking, as reported by Leslie Corsa, Comrade Su Chun of the Division of Scientific Research and Techniques of the Birth Planning Office, State Council of the People's Republic, stated:

> About the methods used in birth planning — in the rural areas most women use IUDs while in the cities women prefer oral drugs. About 50 percent of women of reproductive age using contraception in China use IUDs. . . . In some rural areas 60 to 70 percent use IUDs, but on the average nationwide, 50 percent (41).

This accords with other recent statements. In his diary of a 1977 trip to China, Sheldon Segal noted an even higher figure cited by a Chinese physician:

> Dr. Chang Tse-Feng is in charge of family planning at Capitol Hospital, Peking. She is a graduate of Peking Union Medical College, a member of the last class to finish before the Japanese takeover. Dr. Chang says that a conservative estimate of the percentage of contraceptors in Peking who use intrauterine devices is 60-70 percent. This figure startled me so that I questioned it. The Chinese physicians present, including Dr. Lin Chiao-Chih, seemed to have no doubt about it. In fact, in response to my question on the matter, Dr. Lin stated that she believes that the figure would be a good estimate for all of China. She says, if anything, in the rural areas the percent of contraceptors using the IUD is even greater. Dr. Chang, with Dr. Lin's confirmation, estimates that users of oral contraceptives of all types represent about 20 percent of contracepting couples. Approximately 20 percent are couples which have had sterilization operations, either male or female, but mostly female. Dr. Lin states that there is now a growing transfer from IUDs or oral contraception to sterilization after the first or second child. Abortion is available as a backup throughout China, according to Dr. Lin and Dr. Chang (262).

Table 10. Estimated Number of IUD Users Worldwide, 1977

	Millions of Women	
Developed Country Users		
North America	3	±0.5
Europe	3	±1.0
Asia	1	±0.5
Developing Country Users		
National Programs	8	± 3
People's Republic of China		
900 million people × 70% use of contraceptives × 50% using IUDs × 13% MWRA	41	±10
TOTAL	56	±15

MWRA = married women of reproductive age

Estimating Total Usage

Determining IUD use worldwide is difficult. Program statistics are not always reliable, private physicians do not report IUD insertions, commercial firms do not make sales records public, and national continuation rates vary widely. Moreover, since the People's Republic of China probably has the largest number of users and only very rough estimates are available there, the problem is compounded. Nevertheless, Table 10 provides a crude overview of world use of IUDs in 1978. Approximately 50 to 60 million devices may be in use, 40 million or more in China and 15 million in the rest of the world.

SAFETY AND EFFECTIVENESS

A recent comprehensive three-year review of intrauterine devices by the US Food and Drug Administration has concluded that "IUDs are generally safe, effective, and a useful form of birth control" (337). This reaffirms similar USFDA findings published in 1968 (336). The 1978 report summarizes the current status of the IUD as follows:

> Currently marketed IUDs* [in the US] have a net pregnancy rate of approximately 1 to 6 per 100 women users at the end of the first year. Expulsion rates are reported to range from 4 to 18, and removals for medical reasons due to adverse side effects, 12 to 16 at the end of one year . . . .
>
> In general, morbidity and mortality rates associated with the use of IUDs remain low. In the United States the current mortality rate is estimated to be somewhere between 1 to 10 deaths per million woman-years of use. Furthermore, IUDs are believed to be associated with a higher morbidity but a lower mortality rate than oral contraceptives.
>
> While IUDs are still considered to be generally safe and effective, increased risk of spontaneous abortion, septic midtrimester abortion, and premature delivery pose potential problems in the face of a low but persistent pregnancy rate. Moreover, there is continued and growing concern about the problem of infection resulting from the use of intrauterine contraception and its possible effects on future fertility, particularly among the nulligravid (337).

As this summary suggests, the major clinical issues in IUD research and use today are both old and new. The measures of IUD performance first established in the Cooperative Statistical Program — pregnancy, expulsion, removals for pain and bleeding, and removals for other medical reasons — remain the standard criteria for IUD evaluation. (See Table 11.) In addition, problems that are rarer but generally more serious than pain, bleeding, and expulsion have emerged now that long-term and widespread use has made it possible to detect rare events. These more serious complications include a higher risk, in pregnancies with the device in situ, of an ectopic pregnancy or of a septic second trimester abortion, and possibly also a higher risk of subsequent infertility caused by pelvic infection than among women not using IUDs.

One statement can be made with certainty: no evidence of any kind has been found that IUDs cause or promote cervical or endometrial malignancy (337).

In the developing countries as in the USA mortality rates from IUD use are low. Adapting a computer model developed by the Population Council, Malcolm Potts has estimated the mortality associated with IUD use and with oral contraceptive use for women in various age groups in developed countries and in two types of developing countries (225) (see Table 12 and see

*IUDs marketed in the US are the Lippes Loop, Saf-T-Coil, Cu-7, and Progestasert.

also **Population Reports,** Series A, Number 5, *OCs — Update on Usage, Safety, and Side Effects*, January 1979, Table 27, p. A-171). Under the assumptions of this model, IUD-related deaths annually in developed countries range from 0.5 to 1.0 per 100,000 women aged 20 to 39 (or 5 to 10 per one million women) depending on age, whereas in advanced developing countries (LDCA) like Korea and Taiwan they are double that number and in less advanced developing countries (LDCB)

Table 11. One-year Event Rates for Pregnancy, Expulsion and Removals for Bleeding/Pain in Selected Multicenter IUD Studies, 1970-1979

Device	Author & Date	Ref. No.	Number of Insertions	Woman-months of Use	Rate per 100 Women		
					Pregnancy	Expulsion	Removals for Bleeding/ Pain
UNMEDICATED							
Lippes Loop C	IFRP 1979[a]	114	1,417		2.7	14.0	10.0
	Snowden et al. 1977	285	4,067		1.2	7.4	12.3
	Tietze & Lewit 1970[b]	323	3,489	31,032	3.0	19.1	11.0
Lippes Loop D	IFRP 1979[a]	114	2,502		2.9	11.1	10.0
	Snowden et al. 1977	285	2,082		1.4	5.2	10.1
	Tietze & Lewit 1970[b]	323	7,553	72,046	2.7	12.7	11.7
	WHO 1979	400	894	9,275	2.0	8.3	8.2
Saf-T-Coil	Snowden et al. 1977	285	2,737		1.4	9.3	13.9
	Tietze & Lewit 1970[b]	323	2,463	17,646	2.8	19.3	14.7
Antigon Wing	Snowden et al. 1977	285	421		1.1	9.0	11.8
Antigon Film	Snowden et al. 1977	285	406		1.2	8.8	18.3
MEDICATED							
TCu-200	Jain & Sivin 1977	122	15,662	121,320	2.6	7.7	8.6
	Snowden et al. 1977	285	1,492		0.4	5.7	7.6
	Tejuja et al. 1975	320	4,357	37,429	0.9	7.4	10.8
	Timonen & Luukkainen 1974	325	2,689	29,143	1.6	2.2	7.1
TCu-200 & TCu-220	IFRP 1979[a]	114	3,909		2.0	6.8	6.2
TCu-220C	Sivin & Stern 1979	282	1,850	15,897	0.8	7.0	12.8
	WHO 1979	400	889	9,952	0.6	4.1	5.0
TCu-300	Luukkainen et al. 1974	169	1,420	15,177	1.0	1.3	4.3
	Sivin 1979	271	9,641	67,990	2.0	7.6	9.2
TCu-380A	Sivin & Stern 1979	278	3,536	31,225	0.7	5.5	13.1
Cu-7	Gibor et al. 1972	71	8,065	83,676	1.4	5.9	8.9
	IFRP 1979[a]	114	1,439		2.0	5.1	2.7
	Jain & Sivin 1977	122	1,831	12,289	2.8	15.5	10.0
	Snowden et al. 1977	285	6,098		2.1	11.7	9.4
	Tejuja et al. 1975	320	854	5,177	2.4	6.4	10.9
Multiload-cu250	Theiry et al. 1978	321	2,782	29,669	0.5	2.2	3.7
Nova T	Luukkainen et al. 1979	167	907	8,790	0.7	5.8	12.3
Progestasert	Alza Corp. 1976	13	4,264 (parous)	35,739	1.9	3.1	9.7
			1,231 (nulliparous)	10,109	2.5	7.5	12.1

[a]IFRP data are adjusted for varying age and parity of users of different devices.
[b]Multiple segment data

Source: Adapted from Sivin (271)

they would be nearly triple that number (225). Assuming a failure rate of approximately two per hundred women annually, deaths associated with childbearing when the IUD failed to prevent pregnancy would range from 0.4 to 1.3 per 100,000 per year in Korea-type areas and from 6.6 to 9.5 in Bangladesh-type areas. In other words, there would be about 2 to 3 deaths per 100,000 for those women annually from the IUD compared with up to 9 or 10 per 100,000 from the pregnancies after IUD failure. Without contraception, however, death rates from pregnancy alone would average about 20 times higher than all the IUD and IUD-failure deaths in each type of area. When compared with oral contraceptives, IUDs are about twice as safe as orals used by young women without conditions predisposing them to circulatory disease and three to five times safer than OCs used by older women with predisposing conditions (225, 235). (See Table 12.)

Effectiveness

The IUD is one of the most effective modern methods of contraception. The latest US study of contraceptive efficacy showed an IUD failure rate of 4.2 per 100 married women aged 15 to 44 (see Table 13). In women using IUDs to prevent pregnancy, the failure rate was 2.9 percent; these women were probably in their 30s and careful in checking for expulsion. In women using IUDs to delay or space pregnancy, the failure rate was 5.6 percent (340).

In the US, IUDs are somewhat less effective than oral contraceptives and sterilization, but in developing countries where women are not accustomed to taking a pill every day, IUDs frequently have lower failure rates than orals (225). The great advantage of IUDs, of course, is that the effectiveness of the device does not depend on specific actions of the user such as taking a pill every morning or using a barrier method of contraception at each act of intercourse.

Table 13. Effectiveness of Various Contraceptive Methods Used to Delay or to Prevent Pregnancy, United States, 1970-1973

Contraceptive Method	First Year Pregnancies per 100 Married Women Aged 15-44		
	Used to Delay Pregnancy	Used to Prevent Pregnancy	Rates Standardized for Intent
Sterilization	0.0	0.0	0.0*
Oral Contraceptives	2.0	2.0	2.0
IUD	5.6**	2.9**	4.2
Condoms	13.7	6.6	10.1
Foam, cream, or jelly	16.7	13.1	14.9
Diaphragm	15.9	10.3	13.1
Rhythm	28.8	9.5	19.1
All other	15.1	6.5	10.8

* Tatum attributes a failure rate of about 0.4 to sterilization (312).
**Not statistically significant difference at $p < 0.01$

Source: Vaughan et al. (340)

Mode of Action

Even though the modern era of intrauterine contraception is two decades old, the precise mechanism by which IUDs prevent pregnancy remains unknown. In animals the mode of action of an IUD varies from one species to another, depending not only on anatomical variations but also on physiological differences in reproductive and endocrine systems (337). For example, in fowl and sheep, IUDs block sperm transport; in the guinea pig, cow, and pig they inhibit implantation; and in the guinea pig, rabbit, pig, cow, and ewe, they interfere with corpus luteum function (337).

Table 12. Annual Number of Live Births, Birth-Associated Deaths, and Deaths Associated with Selected Means of Fertility Control per 100,000 Nonsterile Women, by Method of Fertility Control, Age, and Development of Country

Method and Outcome	Age Group/Country Type											
	20-24			25-29			30-34			35-39		
	DC	LDCA	LDCB	DC	LDCA	LDCB	DC	LDCA	LDCB	DC	LDCA	LDCB
No control												
Live births	61,400	45,940	45,950	59,290	43,170	43,170	55,730	39,930	39,930	47,700	34,210	34,210
Birth-associated deaths	6.1	9.2	183.8	7.4	10.8	215.9	13.8	20.0	199.7	21.0	34.2	171.0
Oral contraceptives (without predisposing conditions)												
Live births	1,940	2,650	2,650	1,910	2,600	2,600	1,770	2,410	2,410	1,350	1,840	1,840
Birth-associated deaths	0.2	0.5	10.6	0.2	0.7	13.0	0.4	1.2	12.0	0.6	1.8	9.2
Method-associated deaths	1.2	0.8	0.8	1.2	0.8	0.8	1.9	1.3	1.3	4.0	3.0	3.0
Total deaths	1.4	1.3	11.4	1.4	1.5	13.8	2.3	2.5	13.3	4.6	4.8	12.2
Oral contraceptives (with predisposing conditions)												
Method-associated deaths	1.4	1.0	1.0	1.4	1.0	1.0	11.4	6.0	6.0	28.8	13.0	13.0
Total deaths	1.6	1.6	11.6	1.6	1.7	14.0	11.8	7.2	18.0	29.4	14.8	22.2
Intrauterine devices												
Live births	1,940	1,920	1,920	1,910	1,890	1,890	1,770	1,750	1,750	1,350	1,330	1,330
Birth-associated deaths	0.2	0.4	7.7	0.2	0.5	9.5	0.4	0.9	8.7	0.6	1.3	6.6
Method-associated deaths	0.5	1.0	1.5	0.5	1.0	1.5	0.8	1.5	2.3	1.0	2.0	2.0
Total deaths	0.7	1.4	9.2	0.7	1.5	11.0	1.2	2.4	11.0	1.6	3.3	9.6

DC = Developed Countries; LDCA = Less-developed countries type A, comparable to Taiwan and Korea; LDCB = Less-developed countries type B, comparable to Bangladesh.

Source: Adapted from Potts et al. (225)

In humans the numerous cellular and biochemical alterations induced in the endometrium by the IUD are believed to be responsible for the contraceptive effect (337). All unmedicated and copper devices stimulate an inflammatory or foreign body reaction in the uterus. After IUD insertion numerous polymorphonuclear leukocytes appear in the endometrium and uterine fluids, followed by foreign body giant cells, mononuclear cells, plasma cells, and macrophages (87, 188, 189, 250, 251). These cells may literally engulf or consume the spermatozoa or the fertilized ovum by the process of phagocytosis. This is the most widely accepted theory at the present.

Another theory, not necessarily incompatible, is that changes in the endometrium, perhaps stimulated by the inflammatory reaction, delay the normal hormonal cycle, creating an endometrium inhospitable to implantation (28, 125, 372). No evidence has emerged, however, that IUDs work by causing any fundamental changes in hormonal function or in the menstrual cycle (222).

Medicated IUDs, in addition to producing an inflammatory reaction, have local effects which may play a part in their contraceptive action. IUDs containing copper interfere with enzyme systems (208), with cellular DNA content in the endometrium (89), with glycogen metabolism (236), and with estrogen uptake by the uterine mucosa. Copper increases the inflammatory reaction (182). Copper ions in vitro are toxic to sperm, but this effect is less important than enzyme system interference (123).

IUDs containing progesterone interfere with the normal hormone-stimulated cycle of the endometrium (220, 258). By maintaining high progesterone levels and, in consequence, relatively low estrogen levels, these devices keep the endometrium in the decidual, or progestational, phase, in which implantation is unlikely (259). The small amount of progesterone released by these devices does not appear to affect ovarian function and is not detectable in blood serum (259).

INSERTION AND REMOVAL

Proper insertion of an IUD is critical to the success of the device since it can affect all the major events that determine continuation of use — pregnancy, expulsion, bleeding, pain, and removals for other medical reasons (mainly perforation and infection). In the continuing effort to expand IUD use and improve performance, three clinical issues of current concern are: the timing of insertion, the specific techniques used to assure proper IUD placement in the uterus, and the role of paramedical personnel (see also **Evaluation and Research**, pp. B-77–B-85).

Counseling

Every woman of reproductive age is entitled to accurate and understandable information about family planning methods. A woman who chooses an IUD should be told in simple terms how the device works and how it may affect her. She should know that, like every other method of contraception, the IUD is not foolproof and that there is a small chance she can become pregnant while using it. She should know that if she misses a period or is unable to locate the transcervical threads of her IUD she should return for follow-up care. She should also know the common signs of infection — fever, pelvic pain or tenderness, unusually severe cramping, or unusual bleeding — and be urged to seek help from health care personnel if signs should appear. A woman using a medicated IUD should know when the device is supposed to be replaced. She should be warned against any attempt to remove the IUD herself (100).

The common side effects of IUD use also should be carefully explained. As the Pathfinder Fund points out:

> It is a mistake to belittle potential side effects of an IUD in an attempt to have the woman become an IUD acceptor. In that case, she will probably be surprised and afraid if bleeding or pain should occur, and will want to have the IUD removed immediately. This will give IUDs a poor reputation in the community, and will be detrimental to the family planning program (222).

It is also important for the health care provider to dispel any false rumors about IUDs, for example, that IUDs cause cancer or that a baby conceived with an IUD in place will be deformed. These rumors have been demonstrated false. Anyone who chooses an IUD should also know that if she is ever dissatisfied with the device for any reason, it can be removed (222). Above all, she must know that she can return to a health care center or provider for answers to any questions she may have or help with any problems that may arise.

Timing of Insertion

What is the most appropriate time for IUD insertion? The conventional answer, first provided by Gräfenberg in 1931, is that IUDs should only be inserted immediately after menses (75). As Gräfenberg pointed out, this assures that the woman is not pregnant. Insertion during or immediately after menstruation has other advantages: the cervical os is dilated, the endocervical canal is soft, and any bleeding produced by insertion is masked by normal menstrual bleeding (336, 337).

Many clinics are still following this advice. In a 1976 survey undertaken by IPPF and the US Center for Disease Control, one-third of the 240 respondents limited IUD insertion to the time of menstruation or five days after, regardless of the patient's report of sexual activity or use of other contraceptives (364). For every day beyond menstruation the respondents were less likely to insert an IUD, fearing insertion into a pregnant uterus. In areas where abortion was illegal or not readily available, insertion was even more likely to be limited to menses on the assumption that some women would conceal their pregnancies and deliberately request IUDs in hopes of causing abortion. Nearly half of the African and the Middle Eastern respondents limited insertion to the menstrual period as compared with 13 percent of Asian and 30 percent of European and American respondents. The IPPF report comments:

> The implication of these data is that many women do not have an IUD inserted when they first request it. Women who have traveled long distances to the clinic, have taken time away from their jobs, or who have made special arrangements for the care of their children, are considerably inconvenienced by having to return to the clinic at a later time for insertion of an IUD and may be discouraged from ever obtaining one (364).

The latest research findings show that, from the point of view of safety and effectiveness, some of these precautions are no longer necessary and more attention can be paid to the con-

venience of the potential user. In the last decade investigators have found that IUDs can be successfully inserted after delivery, both in the early and later postpartum period, and immediately after abortion as well as later during the menstrual cycle. In its 1978 report, the US Food and Drug Administration still recommends insertion of IUDs during the menstrual period, but acknowledges that this is not always possible and that it may be "necessary and proper" to insert an IUD at other times (337). Likewise, the World Health Organization has noted that limiting IUD insertion to the menstrual period may not be a practical approach in large-scale family planning programs (367).

For a woman who has neither delivered nor had an induced abortion and who is reasonably sure that she is not pregnant and does not want to become pregnant, the best time to insert an IUD is probably the time she appears in the clinic or health center to request it, regardless of the timing of her menstrual cycle. A study by the US Center for Disease Control investigated event rates for 9,094 women using TCu-200 devices in the first two months after insertion, when those events would be most likely to be influenced by the insertion itself. Rates of both expulsion and pelvic infection were lower the later in the menstrual cycle that the IUDs were inserted; in fact, IUDs inserted during the first five days of the menstrual cycle were twice as likely to be expelled or to produce pelvic infection as IUDs inserted after the seventeenth day. Pregnancy rates and removal rates for bleeding and pain were slightly higher for insertions late in the cycle while rates for medical removal were lowest in midcycle (363). The authors conclude "there is no justification for a blanket policy of inserting IUDs only during the menses" (363).

Postcoital Insertion

While the normal and recommended practice is to seek assurance that a woman is not pregnant at the time of insertion, IUDs have been deliberately inserted, on an experimental basis, immediately after unprotected intercourse when a woman might become pregnant so as to prevent or interrupt a fertilized ovum from implanting in the uterus. Lippes reports that no pregnancies followed insertion of a copper T in 97 young women up to five days after intercourse even though, as he estimated, the risk of pregnancy among the group would otherwise have been about 10 to 20 percent (162). In Holland, A.A. Haspels has recently completed a study of 60 postcoital insertions of the Multiload-cu250 in which no pregnancies resulted (96). This procedure is still experimental and has not been widely reported, but there is no record of morbidity occurring as a result to date (337). Experts suspect that the sooner after intercourse a device is inserted, the more likely it is to be effective (14).

Postpartum and Postabortal Insertion

With regard to postpartum insertions, a comprehensive review of international experience by Rosenfield and Castadot showed that complications were not substantially higher for early postpartum insertions (those performed before hospital discharge) than for those performed after six weeks or unrelated to pregnancy (240). With respect to perforations, for example (excluding one center with an exceptionally high rate), IUDs inserted 48 hours or less following delivery in the International Postpartum Program of the Population Council produced a much lower incidence of perforation (0.2 percent) than IUDs inserted between the fourth and eighth weeks (1.8 percent) or after the eighth week (0.4 percent) (240). With respect to bleeding, no significant differences in removal rates (20) or hemoglobin levels (110) were noted between women receiving IUDs immediately postpartum and those with later insertions or no IUDs, respectively. With regard to pain and infection, incidence was slightly lower among women with early rather than later postpartum insertions (20).

Only with respect to expulsion rates was the rate for early insertions (11.5 percent at one year) about double the rate for postdischarge insertions in the International Postpartum Program (272). Since early postpartum expulsions are followed by a high proportion of reinsertions (65 to 95 percent) and since expulsion rates have declined with increasing clinical experience, this concern has somewhat eased (20, 50, 77, 323). Moreover, research is now underway to develop postpartum IUDs that will resist expulsion and postpartum inserters that will minimize perforation and misplacement (see p. B-83). Overall, continuation rates after one year were slightly higher for women returning later for an IUD (79 per hundred women) than for the immediate acceptors (74), but after four years an estimated 42 percent of the immediate postpartum acceptors were still using IUDs (272).

There are obvious advantages in providing an IUD immediately after delivery for the woman who wants this protection rather than insisting that she make a return visit which may be difficult for her. Gonzalo Echeverry showed that 95 percent of postpartum women requesting an IUD before discharge received the IUD then. On the other hand, only 45 percent of those prospective IUD acceptors who were told to come back for an IUD in six weeks actually returned (50).

IUD insertion immediately after abortion is also proving a safe and effective way to meet contraceptive needs. Although at first doctors feared higher rates of infection and perforation if IUDs were inserted immediately after abortion — and the USFDA still does not recommend IUD insertion either postpartum or postabortion until uterine involution is complete (333) —these fears have not been confirmed in practice. Studies in Chile, Finland, India, Korea, Poland, Sweden, the United States, Yugoslavia and by WHO reveal no serious problems with respect to infection, perforation, expulsion, bleeding, or other events following postabortal insertions (16, 74, 110, 142, 205, 221, 241, 272, 310, 325, 345, 400). Studies have included induced and spontaneous abortions, with and without infection, dilatation and curettage as well as vacuum aspiration, and a variety of different devices, all with similar results. An important benefit of postabortion insertion is to provide effective contraception immediately at a time of proven fertility and high motivation and thus to reduce the likelihood of repeated abortions.

Insertion Technique

Proper insertion and placement of the device are important to reduce the risk of perforation, expulsion, accidental pregnancy, bleeding and pain, infection, and other medical problems. As indicated in the **Guidelines for Use of IUDs** (see pp. B-74–B-75), the objective is to place the device as high as possible in the endometrial cavity without perforating the myometrium. If the device is not placed high in the uterine fundus, the contractions of the lower uterus can more easily expel it. Moreover, most pregnancies occur in the upper portion of the uterus and unless the device covers that area, it will not provide effective protection.

Insertion techniques vary somewhat with different devices and in each case the manufacturer's instructions should be followed precisely. In general, because most IUDs are passed

through the cervix within a tube-like inserter and released in the uterus, the narrower the diameter of the inserter, the easier the insertion process. Most devices introduced recently have specially designed inserters, which, including the loaded device, vary in width from about 0.3 to 2.5 cm. The Progestasert inserter, for example, an improved design, consists of a single curved tube without a plunger. The horizontal arms of the T are positioned outside the inserter and folded back with an arm-cocker attachment just before insertion. The inserter can be manipulated with one hand, leaving the other free to control the tenaculum. Since this design was introduced, its developer, the Alza Corporation, has received no reports of uterine perforations (217).

For other devices, there are two basic methods of insertion, a "push-out" technique and a "withdrawal" technique. In the "push-out" procedure, used for the Lippes Loop and Saf-T-Coil, the tube containing the IUD is inserted just beyond the internal os and the plunger moved forward until the IUD is pushed out of the inserter. Then plunger and tube are withdrawn together. In the "withdrawal" method, used for the copper 7 and copper T, the tube with the IUD is inserted up to the uterine fundus. The outer tube is then withdrawn while the inner rod maintains the IUD in proper position. Finally the rod is withdrawn. The Ts and 7s are generally thought to be easier to insert than the Lippes Loops (240). (See Figure 2.)

Use of Paramedical Personnel

Considerable attention is now being given not only to the design of inserters and measuring devices to assure better placement of the device (see p. B-83) but also to the training required for IUD insertion. Expulsion rates decline as the skill and experience of the person performing the insertion increases (25, 76, 77, 240, 374), but evidence from many countries suggests that properly trained paramedical personnel can insert IUDs as well as medical doctors.

As Table 14 indicates, nurses and midwives performed as well as physicians on the average, and in the largest study, in Thailand, the expulsion rate was substantially lower after insertions by nurse-midwives (370). Adequate training is necessary for all health personnel doing IUD insertions. (For a listing of training courses for nonphysicians, see **Population Reports,** Series J, Number 6, *Training Nonphysicians in Family Planning Services and a Directory of Training Programs*, September 1975.)

To promote IUD use, some countries have specifically authorized IUD insertions by paramedical personnel. In the Philippines, for example, a 1972 Presidential Decree called for training courses for nurses on IUD insertion as well as on oral contraceptive distribution (34). Other countries that have legalized and encouraged IUD insertion by nonphysicians include China, Thailand, Pakistan, Iran, Afghanistan, Ghana, Zaire, Ecuador, and Chile (117, 165, 213, 230, 238, 239, 370, 375).

Removal

The removal of an IUD may be necessary either for medical or for personal considerations. Medical indications and guidelines for removal are listed on p. B-75. Nonmedical indications include a desire by the woman to initiate a pregnancy or to try another form of contraception. Medicated IUDs should be re-

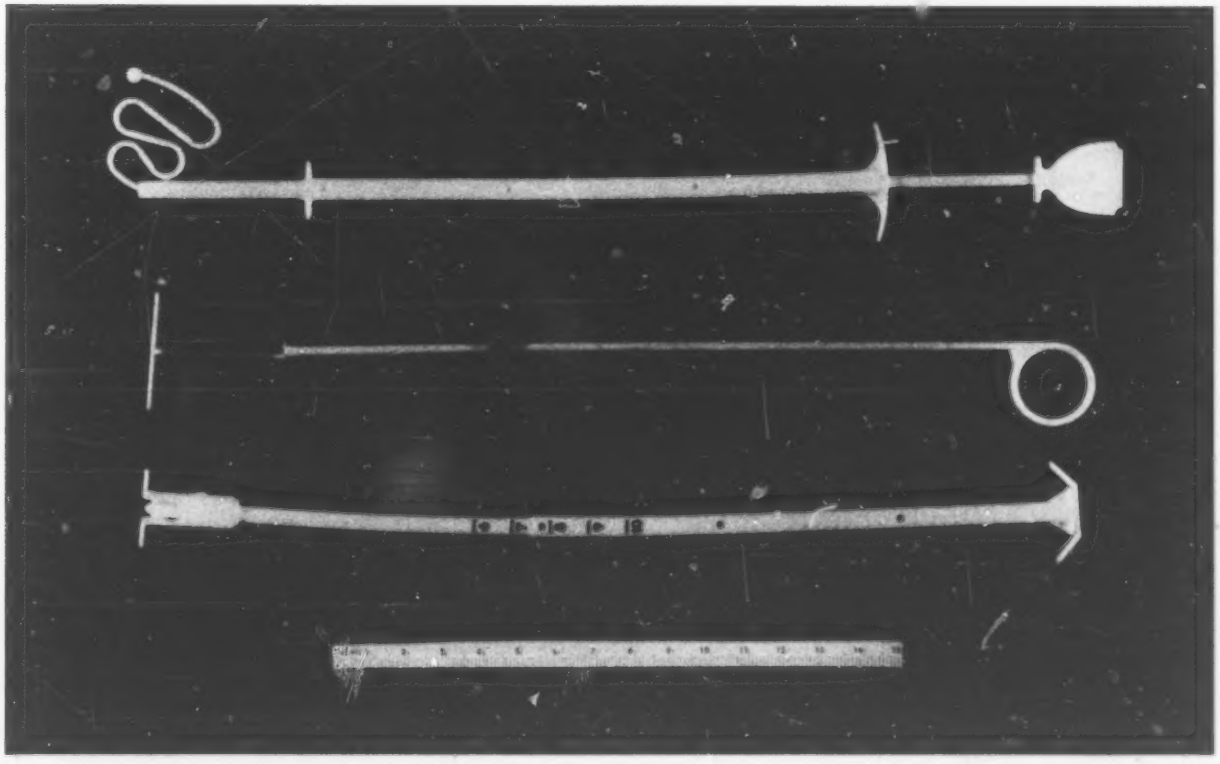


Figure 2. IUD inserters pictured above are, from top to bottom, for the Lippes Loop, standard commercial model utilizing a push-out technique; the TCu-200, utilizing a withdrawal technique; and the Progestasert, utilizing an automatic loading and modified withdrawal technique that can be performed with one hand.

Table 14. One-year Event Rates per 100 Women, by Type of Personnel Performing Insertions, Selected Studies, 1976-1979

Author & Date, IUD Type, and Personnel	Ref. No.	Country	Number of Insertions	Event				
				Pregnancy	Expulsion	Removal: Medical	Removal: Personal	Continuation
Einhorn & Trias[a] 1978	52	Colombia						
Nurses				2.0		8.0		
Physicians				2.0		6.0		
Loghmani & Mitra 1976	165	Iran						
TCu-200								
Midwives			252	4.1	13.8	13.5	2.6	66.3[b]
Physicians			646	2.3	10.1	12.8	1.5	73.7[b]
Pastene et al. 1977	213	Chile						
Lippes Loop D								
Nurses			296	9.3	7.0	1.1	0.0	86.2
Physicians			399	2.2	12.4	3.6	2.7	79.1
Cu-7								
Nurses			174	3.2	8.1	2.5	3.3	82.8
Physicians			340	3.1	2.5	3.1	2.2	89.1
TCu								
Nurses			313	2.3	4.3	4.6	5.5	83.3
Physicians			470	2.2	2.7	6.7	3.1	85.2
Ramos & Apelo 1979	230	Philippines						
Lippes Loop C and D								
Nurses and midwives			162	1.4	19.5	0.6	4.4	74.1
Physicians			188	2.1	13.9	0.7	3.0	80.3
Wright et al. 1977	370	Thailand						
TCu-200								
Nurse-midwives			971	0.9	2.9	6.4	3.0	86.8
Physicians			1,996	1.0	6.7	5.2	5.2	81.9
Zieghami et al. 1976	375	Iran						
Lippes Loop C and D								
Midwives			232	0.5	5.0[c]	17.6	1.7	75.2
Clinic personnel			232	1.9	3.6[c]	14.7	5.2	74.6

[a]Data for six months' use only
[b]Difference is statistically significant ($p<0.05$).
[c]Without reinsertion

moved and replaced periodically if the patient wishes to be sure of effectiveness levels. Unmedicated devices that are performing satisfactorily do not require replacement.

Confronted by difficult removal cases, such as those where the IUD is in the uterus but the strings are not visible, the clinician has several options before resorting to special diagnostic techniques, such as x-rays or sonographs (337). Simple hooks have been successful in probing the uterine cavity and locating and removing IUDs with no other diagnostic measures (397). Hysteroscopy permits direct observation of the uterine cavity and should permit more precise extraction (270). John Guillebaud of Great Britain reports the successful use of a 4 mm Rocket disposable vacuum aspiration curette to retrieve the threads of 35 out of 36 IUDs that were left in uteri with threads not visible (387, 388). The use of x-rays for diagnosis and laparotomy for surgical removal of the IUD should be the last recourse (387, 388). These measures should be used only if the woman is not pregnant, of course.

EXPULSION

IUD expulsion rates in most large studies range from about 5 to 20 per 100 women at one year (see Table 11). They are influenced by the age and parity of the user, the timing of insertion, the interval after insertion, the skill of the person performing the insertion, and the size and nature of the device. About 20 percent of IUD expulsions go unnoticed (323), and approximately one-third of pregnancies among IUD users occur after unnoticed expulsion (178).

Like pregnancy rates, IUD expulsion rates decline with the age of the user; among multiparous women they are about twice as high under age 30 as over (114). Parity also affects expulsion rates (25). Nulliparous women, with small uteri, do not tolerate the larger devices and in fact have higher expulsion rates with all devices (26). Differences in expulsion rates by parity among women who have given birth are much less than the differences between parous and nulliparous women.

Expulsion rates also depend on the skill and experience of the individual performing the insertion. One center in Finland, for example, reports one-year expulsion rates of only one or two per 100 (169,326).

As noted earlier, expulsion is related to the timing of insertion and occurs more frequently after insertions four to eight weeks postpartum or insertions in the first 17 days after the menstrual period (323,363). Expulsion is even more closely related to the period of time after insertion. The highest incidence is in the first three months of use (323); after three years, Lippes reports, no expulsions at all occurred among his patients (163) (see Figure 1). Expulsion takes place most frequently during menstruation, especially the first menstrual period after insertion, when the uterus contracts, exerting a downward force (98, 99).

Different expulsion rates have been observed with different devices. Generally, the expulsion rate is higher with smaller devices than with larger ones of the same design (323). The T- and 7-shaped devices, on the other hand, although smaller in surface area, have lower expulsion rates than the Lippes Loop — about 6 per 100 women at one year compared with about 11 for the Loop (see Table 11). Expulsion rates — and other event rates as well — may be correlated with the fit of the device in the uterus (see Figure 3). Any disorientation of the device within the uterus or a dimensional disproportion between the device and the uterine cavity provokes uterine irritation and myometrial contraction (133). Research is now underway to identify better ways to match the size and shape of IUDs to the size and shape of the uteri of potential users (99) (see pp. B-82–B-83).

From a clinical point of view, expulsion is not a serious problem if it is discovered promptly and if the woman has access to a clinic or other health services. Usually another device can be inserted and retained. In the CSP, two of every three women experiencing a first expulsion had a second IUD inserted, and almost one-half of these retained a Loop for at least six years after reinsertion (323).

Complete expulsion of an IUD exposes the user to the risk of unwanted pregnancy. With incomplete expulsion, the device may become lodged in the lower uterine cavity or the cervical canal, reducing contraceptive protection (352). The IUD user should be aware of both possibilities. She should be showed how to check for the strings of the device after each menstrual period. She should be advised to seek help if the device appears to be out of its normal position or missing and to refrain from intercourse or use another form of contraception until a new IUD can be inserted.

PERFORATION AND EMBEDDING

The use of an IUD carries with it the risk that the device may perforate the uterine wall, migrate into the peritoneal cavity or become lodged in the musculature of the cervix. While relatively rare, these conditions are sometimes difficult to diagnose and can lead to serious consequences for the IUD user. Opinions are divided as to proper clinical management.

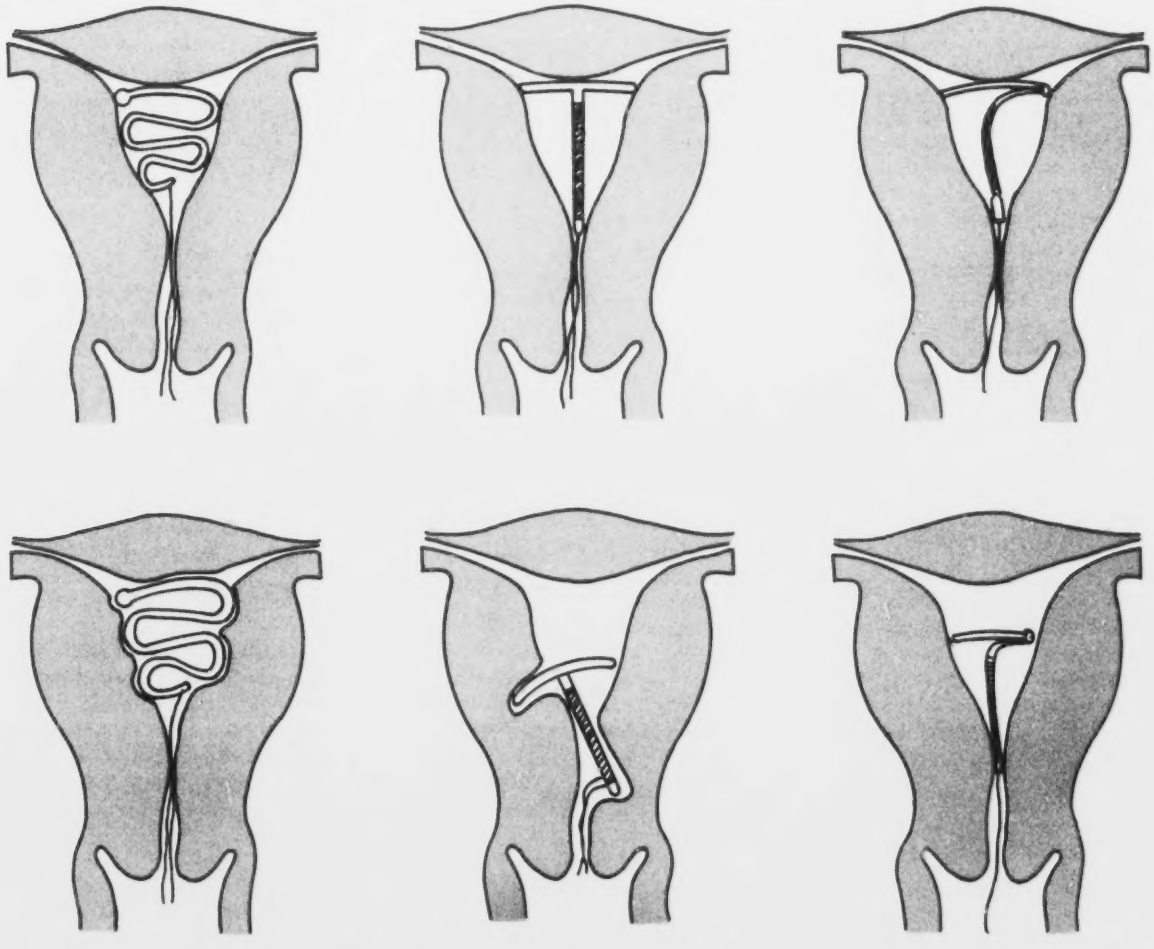


Figure 3. In the top row, left to right, a Lippes Loop, TCu-200, and Cu-7 device are shown in proper position high in the uterine fundus; in the bottom row are shown a Loop that is too large for the uterus and is pressing into and irritating the endometrium, a TCu-200 that is perforating the cervix, and a Cu-7 that is too small for the uterus and has slipped or been forced out of position by uterine contractions. IUDs in the bottom row would be likely to produce higher rates of pregnancy, expulsion, and removal for bleeding/pain.

Tatum identifies four variables that influence the risk of fundal perforation: the size, shape, and consistency of the device; the status and configuration of the uterus; the insertion technique; and the skill and experience of the operator (308). The last is crucial. As Lippes observes, "IUDs do not perforate. For this to happen we need a practitioner" (159).

The incidence of fundal perforations is difficult to establish because they often take place without bleeding or pain and so remain undetected. The Cooperative Statistical Program estimated the incidence of perforation at less than 1.2 per 1,000 insertions (323), but one center reported initial perforation rates as high as 8.7 per 1,000 insertions (323). Most perforations begin or occur at the time of insertion (286); possibly all do. Of the two basic insertion techniques, withdrawal and push-out, the push-out method is more likely to result in perforation (240, 308, 337).

While fundal perforations are usually the result of improper insertion, cervical perforations are the result of downward displacement of a device in response to uterine contractions (97). (See Figure 3.) This can occur with any device with a vertical arm such as the T or 7 devices. The incidence of cervical perforation is not known because it is almost always asymptomatic (309). In order to minimize this type of perforation the Population Council added a plastic ball to the tip of the T's stem (309). If cervical perforation is discovered the IUD should be removed. This may be done by grasping the vertical arm of the device with forceps and applying upward pressure to dislodge the tip of the device. The device can then be removed in a conventional manner (97).

Diagnosis of fundal perforation by an IUD is sometimes difficult, especially if radiologic or sounding procedures are not available. The condition should be suspected if pregnancy occurs, if the tail of the device is not visible, or if the user experienced sharp pain at the time of insertion (308). Diagnosis can be made by hysterography or hysteroscopy or by placing a sound in the uterine cavity and obtaining lateral and anteroposterior x-rays of the pelvis (176). In place of a sound, some clinicians insert a second IUD of a different type as a uterine marker. When the appropriate equipment is available, ultrasound offers a noninvasive and effective means of locating "lost" IUDs without exposing the patient to x-radiation (279).

Some controversy exists over the management of extrauterine IUDs, specifically of inert devices, such as the Lippes Loop and Saf-T-Coil. On the one hand, Richard Soderstrom, based on experience at the Mason Clinic in Seattle (USA), recommends that all intraabdominal IUDs, symptomatic or asymptomatic, be removed (287). He speculates that some of the bacteria introduced during insertion may survive in an "inflammatory cocoon" and could cause infection if there were a change in host resistance (287). The USFDA report notes that any intraperitoneal device has the potential to cause inflammation or intestinal obstruction (337). On the other hand, Lippes recommends that these devices be allowed to remain in the peritoneal cavity as long as the user is asymptomatic on the grounds that the risks of surgery and postoperative complications are greater than the risks involved in leaving the IUD in place (159). He points out that at least two deaths have been reported in the US as a result of surgery to remove an asymptomatic device (130) but that there are no reports of deaths caused by linear devices remaining in the peritoneal cavity after perforation (159).*

There is no controversy over the management of closed types of IUD or those containing copper; they should be removed as soon as possible. Closed devices, such as the ring or bow, can cause bowel strangulation while copper devices elicit an intense tissue reaction leading to the formation of omental adhesions (309).

Hazards involved in perforation by a progesterone-bearing IUD have not yet been assessed. The speculation is that there would not be the same reaction as with copper since progesterone is a rapidly absorbed, naturally occurring hormone (337).

Removal of IUDs that have perforated the uterine cavity can often be accomplished by laparoscopy, although laparotomy may sometimes be required. Some investigators have reported success in locating and extracting perforating IUDs by hysteroscopy when the device is partly in the uterine cavity (270).

BLEEDING AND PAIN

The most frequent problem for IUD users is increased bleeding, often accompanied by cramplike discomfort or lower back pain. This increased bleeding takes the form of

- greater volume of flow during menstrual periods (for all but progestin-releasing IUDs)
- prolonged duration of menstrual periods
- more frequent spotting between menstrual periods.

These conditions constitute a personal inconvenience to many users, a social problem in certain cultural settings, and a potential cause of anemia. The programmatic result is that about 5 to 15 percent of all IUD users have the device removed because of bleeding and pain within the first 12 months (see Table 11).

Volume of Flow

It has been recognized for some time that most IUDs increase the volume of blood flow during menstrual periods. More than a dozen studies in at least six countries — Denmark (88), Egypt (102, 107), Mexico (69), Sweden (143, 157, 171, 245, 246, 357), the United Kingdom (82, 83, 84, 186), and the United States (116, 149) — have documented this fact.* (See Figure 4.) Normal menstrual blood loss by healthy women averages about 35 ml (94, 116, 357). With unmedicated devices such as Lippes Loop C or D, Dalkon Shield, Saf-T-Coil, or Birnberg Bow, menstrual blood loss measured at various intervals after insertion is approximately doubled from normal or preinsertion levels with average increases ranging from about 20 to 50 ml (69, 83, 84, 88, 105, 107, 116).

Blood loss can also be evaluated by comparing the percentages of women who experience excessive bleeding before and after IUD insertion. Menorrhagia (usually defined as blood loss exceeding 80 ml) occurred in 48 percent of Danish women after IUD insertion (88) and 51 percent of UK women after IUD insertion as compared with 14 percent of the UK women before insertion (84). Incidence of menorrhagic periods among Swedish women (defined in this study as periods with blood loss exceeding 60 ml) was 46 percent for women with the

*Note: Menstrual blood loss in these studies is determined by the Hallberg-Nilsson method (95) in which all pads and tampons are collected and soaked in a 5 percent sodium hydroxide solution, thus permitting recovery of alkaline hematine which is then determined spectrophotometrically.

***Editor's Note:** Readers are invited to submit for further evaluation case reports of mortality resulting either from an extrauterine linear device left in place or from surgery to remove an extrauterine linear device.

Lippes Loop compared with 15 percent for women without IUDs (357). (Based on the experience of Swedish women, Göran Rybo estimated that an average increase in blood loss of 31 ml would mean a 15 percent increase in the number of women with menorrhagia or mean blood loss exceeding 80 ml; an increase of 41 ml would mean a 25 percent increase in women with menorrhagia) (245).

With copper 7 and copper T devices, menstrual bleeding is also increased, but by a smaller amount. Most studies show postinsertion increases of 10 to 30 ml or about 50 percent (84, 107, 116, 143, 156, 157, 171). In a British study the percentage of women using the Cu-7 who experienced menorrhagia was about 25 percent, compared with 50 to 60 percent for women using the Lippes Loop and 10 to 15 percent for the entire group before insertion (84, 186). In Sweden, 24 percent experienced menorrhagia after insertion of a copper 7, compared with 14 percent before insertion (171).

The smaller increase in bleeding with copper devices as compared with the Lippes Loop seems to be caused by the smaller surface area of the device rather than the addition of copper; adding copper to the Lippes Loop in one study produced even more bleeding during the first six cycles (107).

In general, studies with both unmedicated and medicated devices suggest that the amount of menstrual bleeding in individual women with IUDs does not change greatly over time even though a woman's subjective impression as she becomes accustomed to the new pattern may eventually be of a decline (88, 245). Evidence also suggests that women who report heavier than normal menstrual bleeding before IUD insertion experience a smaller increase in bleeding after IUD insertion and even in some cases a decrease (143). This suggests that heavy bleeding should not be automatically regarded as a contraindication to IUD use (143).

Unlike the unmedicated or copper IUDs, progestogen-releasing devices reduce the volume of menstrual bleeding below preinsertion levels and this reduction may continue gradually over several months. Studies in the UK, Finland, US, and Sweden suggest a reduction in mean blood loss of 40 to 50 percent among women using progestogen-releasing devices compared with preinsertion levels (80, 168, 246, 373). This reduction is comparable to that produced by steroidal oral contraceptives (102). Fouad Hefnawi's study in Egypt of a progesterone-releasing U-coil showed total monthly menstrual bleeding reduced to less than 5 ml after three months (107). Carl Nilsson and Tapani Luukkainen in Finland found bleeding with a norgestrel-releasing T reduced by about 40 percent (193, 196). Dysmenorrhea, or painful menstruation, has been reduced by about one-third with progestin-releasing devices, according to Swedish and US reports (349, 373).

Duration and Timing of Flow

In addition to changes in volume of menstrual blood flow, the duration of menstrual bleeding is often prolonged by an IUD in situ. In a study of 518 Canadian women, Lise Fortier found that approximately 70 percent had longer menstrual bleeding periods with Loops and copper Ts than previously (64). Roland Malmqvist noted that periods were prolonged by about half a day in 32 of 82 women (39 percent) using copper 7s (171). In a 1978 study of 281 English women, Guillebaud found menstrual periods lasted about a day and a half longer for the copper 7 users, and three-fourths of a day longer for Lippes Loop users (83). In a similar study, he found menstrual periods prolonged for three or four days in 25 women using the Progestasert (80). Often this prolonged bleeding takes the form of spotting (defined as bleeding too light to require the use of protective pads or tampons) (349, 373).

A third menstrual irregularity associated with IUDs is an increase in intermenstrual bleeding, also called breakthrough bleeding or midcycle bleeding. While there is some controversy over accurate measurement of bleeding intervals and of cyclical patterns, especially if they are disrupted by various contraceptive methods (174, 237, 284), breakthrough bleeding has been noted with all IUDs but is somewhat more frequent with progesterone-releasing devices (243, 337). About 40 percent of Canadian women, for example, reported intermenstrual

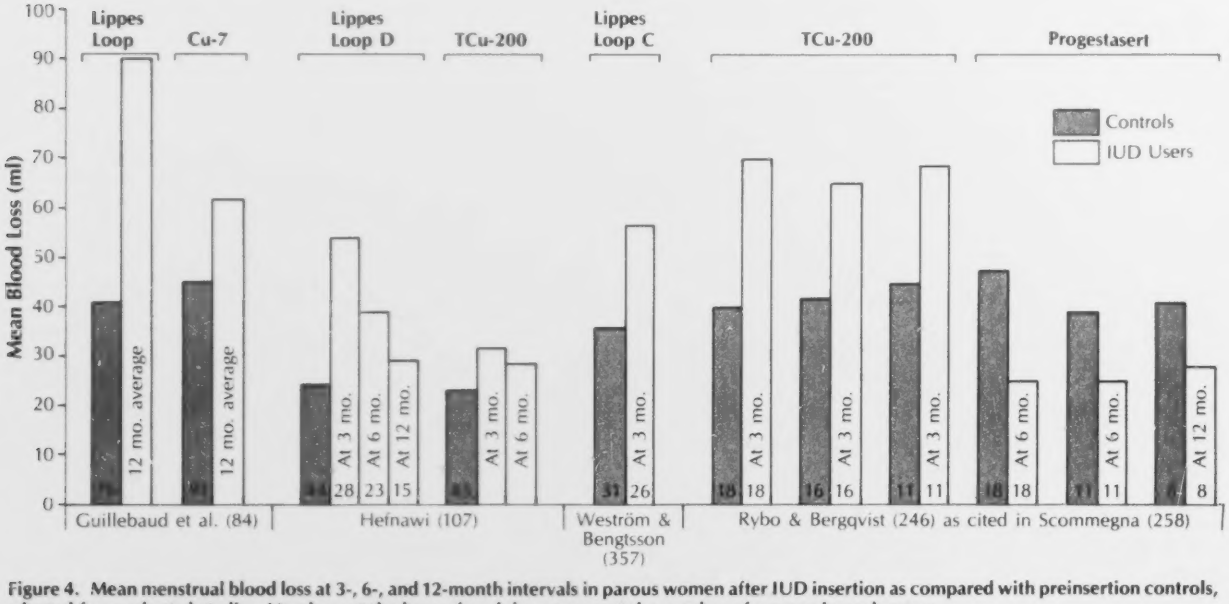


Figure 4. Mean menstrual blood loss at 3-, 6-, and 12-month intervals in parous women after IUD insertion as compared with preinsertion controls, adapted from selected studies. Numbers at the base of each bar represent the number of women in each group.

spotting and/or bleeding with the Lippes Loop and 25 to 32 percent, with copper devices (64). This compares with about 50 percent of multiparous Progestasert users in data gathered by the Alza Corporation (13). Unlike regular menstrual bleeding, the amount of midcycle blood loss attributable to IUDs is usually small (less than 10 ml) and declines with time elapsed after insertion (218, 245).

Effects of Heavy Bleeding

From a woman's point of view, any irregularities in menstruation, and especially increased bleeding, represent a source of personal inconvenience that should not be underestimated. In rural areas of developing countries where modern sanitary napkins and tampons are not available, heavy bleeding is difficult to manage. In countries where menstruating women are not permitted to prepare certain foods, carry on their usual household tasks, perform religious rites, or engage in sexual intercourse, any prolongation of bleeding or midcycle spotting can disrupt personal and household routines (362). As a result, not only the IUD user but also her husband or mother-in-law may insist on removal of the device.

From a medical point of view, the most serious effect of increased menstrual bleeding is the increased danger of anemia. Several studies of well-nourished women in developed countries, where about 5 to 25 percent of women of reproductive age may be anemic (88, 94, 245), have shown that plasma ferritin (82) and hemoglobin levels decline after IUD insertion (82, 83, 116, 186, 245), although others have shown no effect (143, 156). In two studies — one Danish, one US — the incidence of anemia (defined as hemoglobin levels < 12g/100 ml) increased fivefold among women whose mean blood loss after IUD insertion exceeded 80 ml (88) or (in the US study) 60 ml (116). Insertion of a progestogen-releasing device, however, which reduced menstrual bleeding, produced a rise in hemoglobin after insertion (193).

In developing countries at least half the women of reproductive age are likely to be anemic (105), their condition often aggravated by poor nutrition, parasitic disease, and frequent pregnancy and lactation. A Mexican study of hemoglobin levels in 78 women six months after IUD insertion showed declines in hemoglobin in all the women with inert or copper devices but much less or no decline in women using several progesterone-releasing devices (69). In India, however, no significant difference in mean hemoglobin level was observed between 105 women with Lippes Loops inserted postpartum and 105 postpartum women not using IUDs, all of whom were given iron supplements (110). Nonetheless, for some women in developing countries the continuing effects of heavy blood loss from IUD use could constitute a serious health problem.

Cramplike pain is also experienced by some IUD users. Usually manifested as discomfort in the uterus, lower abdomen, or back, it may be caused by uterine contractions that are intensified in an attempt to expel the foreign body (384). Contractions are usually greatest immediately following IUD insertion and may be exacerbated by menstruation.

From a programmatic point of view, bleeding and pain account for about 4 to 15 removals per 100 women after one year, or about twice as many removals as other medical causes (see Figures 1 and 6). Although the copper devices usually produce a much smaller increase in menstrual blood loss than the Lippes Loop, bleeding/pain removal rates for the copper devices in the largest studies are only slightly lower than the comparable 12-month removal rates for the Loop — 8 or 9 per 100 women with copper as compared with 10 or 11 with the Loop. In most studies, bleeding and pain are classified together. In the Tietze collaborative studies an equal number of removals were attributed to bleeding alone and to bleeding and pain together (about 1,300). Pain alone accounted for 620 of 3,266 removals for bleeding and pain during the first and second years of use (323). IUDs removed because of bleeding and pain are rarely reinserted (323).

The cause of increased menstrual bleeding is not precisely established, but it is believed that enzymes which break down proteins and activate the dissolution of blood clots (plasminogen activators) become concentrated in the endometrial tissue adjacent to the device (143, 144, 145, 157, 245, 310). These enzymes cause increased fibrinolytic activity, that is, splitting up of the fibrin which forms the essential portion of blood clots. A greater volume of blood flow is thus produced. It is also suspected that the onset of menstrual bleeding in IUD users is premature, taking place about two days early, before the end of the luteal phase. At this time plasma levels of progesterone are higher than normal for the onset of menstruation. This hormonal asynchronization may account for both the longer duration and the increased volume of menstrual flow (29, 172, 205). Intermenstrual bleeding with unmedicated and copper devices, on the other hand, is thought to be primarily due to mechanical damage to the endometrium which heals over time (245).

Clinical management of menorrhagia is not entirely satisfactory even though many different methods of therapy have been tried, including hormones, vitamins, coagulants, antifibrinolytic agents, prostaglandin synthetase inhibitors, antihistamines, and vasoconstrictors (35, 111, 337). There have been few reported efforts to evaluate the use of oral iron supplements or antibleeding therapy for IUD users in family planning programs in developing areas (110). Research is underway, however, to develop IUDs that will release antifibrinolytic and other agents directly into the uterus (see p. B-82).

In Sweden, Britain, and the US, studies have shown that the two synthetic amino acids epsilon aminocaproic acid (EACA) and the newer tranexamic acid (AMCA), both of which are potent inhibitors of the activation of plasminogen to plasma, are effective orally in reducing menstrual bleeding (31, 197, 199). Bleeding after treatment with EACA and AMCA was comparable to that experienced by women using oral contraceptives, that is, about 50 percent lower than before, and some of the same side effects — nausea, dizziness, and headache — occurred; duration of bleeding was not altered. AMCA produced fewer reported side effects than EACA (197). Oral administration of EACA (141, 170) and AMCA (357) specifically to control bleeding after IUD insertion has proved effective. In one study, AMCA limited the increase in menstrual blood loss to 11.5 percent (357). In the large doses required to limit menorrhagia, however, side effects are frequent (31).

Mefenamic acid, an inhibitor of prostaglandin synthetase, is also being tested (15, 81). In 25 IUD users both with and without menorrhagia, mefenamic acid capsules (250 mg) produced about a 20 percent reduction in bleeding as compared with pre- and posttreatment periods (81).

Although it seems to be effective, additional oral therapy in conjunction with the IUD may not offer great advantages compared, for example, with oral contraceptives. Further, it may, over a long period of time, raise some of the same systemic problems of side effects and of blood clotting that orals do. At

present these therapies have not been studied or endorsed by the US Food and Drug Administration (337). Research is underway throughout the world to find an adequate solution to bleeding problems caused by IUDs.

INFECTION

Recent studies have shown that IUD users run a higher risk of pelvic inflammatory disease (PID) than nonusers. The risk is higher not only immediately after insertion, but also for as long as the device remains in place. Among IUD users, young nulliparous women may face a greater risk of PID than older women or multiparous women. PID takes a variety of forms, including gonorrhea, tubo-ovarian abscesses, endometritis, salpingitis, and actinomycosis, many of which have the potential to produce subsequent sterility, but in many cases PID is mild, asymptomatic, and heals without treatment.

Quantifying the relationship between IUD use and PID is difficult for two reasons: imprecise criteria for diagnosis of the disease and lack of a standard reference group for comparison (160, 337). Pelvic inflammatory disease consists of several conditions; diagnostic criteria differ among practitioners. Among the symptoms are fever, tenderness in the lower abdomen, tenderness upon cervical manipulation, adnexal tenderness, and sometimes vaginal discharge. Recently, however, the increased use of laparoscopy and the growing number of women seeking sterilization have provided a better opportunity for clinicians in both developed and developing countries to observe the condition of tubes and other reproductive organs and to assess the frequency of infection among former IUD users and users of other methods (40, 216, 280, 307). Still, it is difficult to estimate accurately the relative risk of PID faced by IUD users when the precise incidence of PID in the general population is not known (307). In some studies, users of oral contraceptives comprise a large proportion of the comparison group, and oral contraceptives appear to reduce the risk of PID, as do barrier methods (40, 56, 358).

It was fear of pelvic infections that led physicians in the 1920s and 1930s to be skeptical of IUDs. Tietze's collaborative studies allayed fears of serious infection — especially when women with acute PID were screened out — but the data documented a rate of 7.7 infections per 100 woman-years during the first 15 days after insertion compared with 2.2 infections per 100 woman-years 13 to 24 months later (323). About one-third of the removals attributed to "other medical reasons" (that is, other than bleeding and pain) were cases of PID. These represent only about half the cases that occurred.

Today, concern over PID is on the rise again. New clinical data suggest that it is about four times more common in IUD users than in nonusers (56, 59, 207, 307) and that it may occur as much as two years or more after insertion. In many cases the infection may be low-grade and asymptomatic, but it poses a long-term danger of tubal infection leading to sterility and of a sudden flareup complicating spontaneous abortion (see pp. B-69, B-77).

Recent studies of IUD use and PID in Sweden and the US show relative risks ranging from 1.7 to 9.3 for IUD users compared with nonusers (see Table 15). For example, in a case-comparison study of 515 Swedish women with acute salpingitis, Lars Weström and colleagues concluded that nulliparous IUD users were seven times as likely to develop PID as nulliparous nonusers (358). Multiparous IUD users, on the other hand, were only 1.7 times as likely to develop PID as multiparous nonusers. Standardized for age and parity, the relative risk among all IUD users was 2.9 (see Table 15) (207, 358). In the US, David Eschenbach and colleagues showed the risk was 4.4 times higher in IUD users than in nonusers ($p < 0.001$) (56). Among previously pregnant women the relative risk was 3.4; 33 percent of the cases were IUD users compared with 15 percent of controls. In contrast, among never pregnant women, 18 percent of the cases were IUD users as compared with 2 percent of controls. This reinforces Weström's conclusion that the risk of IUD-related PID is greater for nulliparous women. Also, for this group of women the relative risk for gonococcal PID was 2.8; for nongonococcal PID, 6.5, suggesting that the IUD increased the risk of nongonococcal PID more than the risk of gonococcal PID (56).

A US case-comparison study of 350 women by William Faulkner and Howard Ory showed that IUD users had about five times as great a risk of developing febrile PID as nonusers (59). Thirty-eight percent of women with febrile PID were using an IUD at the time of diagnosis, compared with 11 percent of controls and 24 percent of women with afebrile PID. The investigators looked at cases with a temperature of at least 38° C separately to be certain that biased diagnosis did not account for the association.

A puzzling finding in a recent study by Michael Smith and Richard Soderstrom is the high incidence of salpingitis (tubal inflammation) among IUD users (280). Chronic, nonbacterial salpingitis was observed in 23 out of 49 IUD users (47 percent) undergoing laparoscopic sterilization compared with only 10 in 1,500 nonusers (0.7 percent). Smith and Soderstrom comment:

> Perhaps this observation lends additional histologic support to those who propose decreased host resistance to bacterial infection as the explanation for IUD-related inflammatory morbidity. Although speculative, it seems logical that organisms gaining entrance to the reproductive tract at the time of menstruation are disposed of less well by the chronically inflamed endometrium and oviduct (280).

They suggest that chronic tubal inflammation may be responsible for some of the symptoms commonly associated with IUD use, such as heavy, noninfectious leukorrhea and chronic pelvic discomfort.

There is also evidence from the developing world of IUD-related PID. In Thailand, investigators at four Bangkok hospitals looked for evidence of past pelvic infection among more than 1,500 healthy, previously fertile women seeking sterilization (40). Nearly 10 percent showed evidence of previous infection; users of IUDs only had the highest percentage of tubal adhesions, 12.3; users of steroidal contraceptives only had the lowest percentage, 4.1 to 4.9.

PID among IUD users has involved a number of different organisms (36), many of which can spread through the reproductive system. Acquired gonorrhea in IUD users, for example, has a tendency to ascend, leading to tubal and other pelvic infections (244, 299). In other words, while the gonococcus may be important in initiating acute PID, its primary role may be in preparing the way for secondary invaders from normal vaginal flora to reach the upper genital tract (36). It should be noted that copper IUDs do not provide the toxic action against gonococci in women that they exhibit in vitro (207). Infected

Table 15. Pelvic Inflammatory Disease (PID) and IUDs, Selected Studies, 1968-1977

Author & Date	Ref. No.	Place	Study Design	Number of Women	Description	Findings
Combined Bangkok Hospital Group & Wright 1975	40	Thailand	Cohort	1,583	At sterilization, women were examined for evidence of old infection.	10.9% of 516 who had ever used IUDs had tubal adhesions, compared with 6.0% of 1,067 never users ($p=0.001$); 12.3% of 162 who had used only IUDs had adhesions, not significantly different from never users. Risk decreased with duration of use.
Eschenbach et al. 1977	56	USA	Case-comparison	204 cases, 707 controls	IUD use in those diagnosed as having acute PID compared with use in controls from venereal disease and gynecology clinics.	30% of cases and 15% of controls used IUDs ($p<0.005$). In 157 matched pairs of cases and controls, 29% of cases used IUDs, 10% of controls; relative risk: 4.4 ($p<0.001$). 19% of 53 never pregnant cases used IUDs, 2% of 53 matched controls; 33% of 120 previously pregnant cases used IUDs, 15% of matched controls.
Faulkner & Ory 1976	59	USA	Case-comparison	150 cases, 200 controls	IUD use in 50 cases with fevers of 38° C or more and 100 cases with lower temperatures compared with use in controls.	38% of cases with fever used IUDs, 24% of cases without fever, 11% of controls. Age-standardized risk ratios: fever cases: 5.1; cases without fever: 2.7. No duration of use effect.
Lippes 1975	158	USA	Case-comparison	91 cases, 38 controls	IUD use compared in cases and controls. Data from inpatient records.	14.3% of cases and 7.9% of controls used IUDs; risk ratio: 1.9 (not significant, $p>0.05$)
Phaosavasdi et al. 1975	216	Thailand	Cohort	200	At sterilization, women were examined for evidence of infection.	28% of 101 IUD users had evidence of PID, compared with 4% of 73 users of hormonal contraception and none of noncontraceptors. PID less common in those whose IUDs were inserted within 3 months postpartum or postabortion than at other times. Risk increased with duration of use.
Targum & Wright 1974	307	USA	Case-comparison	50 cases, 50 controls	IUD use compared in cases and controls.	48% of cases and 10% of nonsterilized controls used IUDs ($p<0.001$). 59% of ever pregnant cases used IUDs, 45% of never pregnant cases. No duration of use effect.
Vessey et al. 1976	341	Britain	Cohort	17,032	Rates of diagnosis of salpingitis, PID, endometritis compared for IUD users, diaphragm users, and OC users. 18.6% of participants used IUDs at entry into study, 56.6% OCs, 24.8% diaphragms.	Rate per 1,000 woman-years of follow-up by method at entry: IUDs: 2.46; OCs: 1.02; diaphragms: 0.94 ($p<0.001$). Rate of new cases by method actually used: IUD: 2.59; not IUD: 0.94 ($p<0.001$)
Weström et al. 1976	358	Sweden	Case-comparison	515 cases, 741 controls	IUD use in cases of laparoscopically verified acute salpingitis compared with use in controls, all using some contraceptive method.	24.3% of cases and 9.7% of controls used IUDs; relative risk: 3.1. Relative risk for never pregnant: 6.9; for those pregnant at some time: 1.7. Pregnancy status made greatest difference in risk for those age 20 or younger. Overall, risk declined slightly with age, but trends by pregnancy status not consistent. (See Ory (207).)
Wright & Laemmle 1968	369	USA	Cohort	108 cases within 1 year of end of last pregnancy	Cases were women with "definite" first diagnosis of PID who had returned to hospital to obtain contraception at postpartum clinic. Rates by contraceptive method estimated on basis of method choices of all postpartum clinic attendees in same period.	Estimated rates per 1,000 woman-years: IUD: 66.2 OC: 13.4 other (barrier & rhythm): 25.2

ovarian cysts have also been seen in IUD users; microorganisms present in one study included *staphylococcus aureus hemolyticus* and *coli bacillus* (73).

Pelvic actinomycosis, a fungus infection which was formerly quite rare, has now been reported in a number of IUD users (86, 109, 151, 254). These cases include both women with severe pelvic infection and women in whom evidence of the disease was found only at the time of IUD removal (72, 92). Health personnel should be aware of the possibility of actinomycosis infection in any users of IUDs who have a persistent vaginal discharge (86). The recommended treatment is large doses of penicillin or other antibiotics (254).

The question of whether the transcervical tails used on IUDs increase the risk of infection as compared with tailless devices has not been resolved. This first became a matter of concern in 1973 and 1974 with reports of deaths from septic abortion among US women using the Dalkon Shield (124, 154, 327). Tatum suggested that the multifilament tail of the device could act as a wick to permit the ascent of pathogenic bacteria from the vagina into the uterus (314, 315, 316). This theory has not been universally accepted, however. Willard Cates and colleagues pointed out that two sizes of Dalkon Shields were in use at the same time — the standard size and a smaller size for nulliparous women, both with the same kind of tail — and the morbidity and mortality were reported only with the larger model (33).

Measures to prevent or minimize the risk of IUD-related pelvic infections have so far centered on the insertion process. Bacteria are invariably introduced into the uterine cavity at that time, even though Daniel Mishell and Dean Moyer have shown that the uterus normally cleanses itself of bacteria within 48 hours (183). Nevertheless, although no systematic evaluation has been made, it seems a reasonable precaution to ensure that both the IUD and the insertion equipment are sterile at the time of insertion.

Women with evidence of pelvic infection should not be fitted with an IUD until the infection has cleared. Where possible, IUD recipients should be screened by culture for asymptomatic gonorrhea (151, 337). Young women under 30 who have multiple sexual partners and frequent sexual relations should be warned that IUD use will further increase the risk of PID (207).

Opinion is divided on the best course of treatment once PID has been diagnosed in an IUD user. Some US physicians recommend removing the device immediately, especially if the infection proves to be gonorrheal (72, 244, 299). Others recommend treatment with antibiotics and removal of the device only if the patient does not respond quickly to treatment (178). Current US Food and Drug Administration professional and patient labeling recommends immediate treatment with a broad spectrum antibiotic, and removal only if marked improvement does not follow treatment within 48 hours (337).

PREGNANCY

When an IUD fails and pregnancy occurs, the pregnant woman needs the special attention of health care personnel. If she wishes to continue the pregnancy, removing the IUD will improve her chances of having an uncomplicated pregnancy and delivery, but her risks will still be higher than those of non-IUD users. A pregnancy in an IUD user is more likely to be ectopic than in a nonuser, but whether IUDs cause ectopic pregnancy or simply fail to prevent it adequately is not yet clear. Health personnel need to be particularly alert to the possibility of ectopic pregnancy because its symptoms can be mistaken for side effects of the device itself.

Uterine Pregnancy

A uterine pregnancy occurring with an IUD in place is more likely to end in spontaneous abortion than a pregnancy in a woman not using an IUD. Other complications of pregnancy may also be more frequent, but there is no evidence that the pregnancy is more likely than usual to result in an infant with congenital anomalies (181, 215, 285). In a few cases infection of a midtrimester pregnancy with an IUD in place has led to the user's death.

Studies of uterine pregnancy after IUD failures show consistently that about half will end in spontaneous abortion, usually in the first trimester, if the device remains in place (12, 140, 155, 268, 285, 313, 342, 346). This is three to eight times the rate of miscarriage for other women (138, 268, 342). Furthermore, a recent US case-comparison study involving 287 cases found that IUD users were about twice as likely to develop fever (symptomatic of infection) at the time of spontaneous abortion as were nonusers (138). Removing the IUD will cut the risks of spontaneous abortion at least in half (12, 285, 313). There is also some evidence that the continued presence of an IUD increases the risks of premature delivery (12) and stillbirth (268). Tatum and colleagues observed that four times as many premature births occurred when copper Ts were left in place as when they were removed (313).

In the early 1970s accumulating case reports in the US focused attention on a small number of deaths from septic abortion in IUD users. A survey of US physicians conducted by the USFDA's Advisory Committee on Obstetrics and Gynecology uncovered 289 cases of septic midtrimester abortion in IUD users, including 21 deaths (124). A subsequent analysis of data for 1972 through 1974, conducted by the US Center for Disease Control (CDC), estimated that about 15 deaths occurred for every 100,000 pregnancies with an IUD remaining in place (33). Of the 50 US deaths associated with spontaneous abortion in those years, 23 were IUD users'. While the death-to-case rate for IUD users is more than 50 times higher than that for US non-IUD users in that period, the figure makes clear how rare such deaths were. The deaths apparently occurred in women whose initial complaints were general symptoms of septicemia rather than the uterine cramping and bleeding that usually are the first signs of spontaneous abortion (33, 39). Nonfatal cases of febrile spontaneous abortion in IUD users have exhibited the same symptoms as those seen in non-IUD users, raising the possibility that the deaths occurred because the nature of the symptoms in these IUD users delayed correct diagnosis (138).

The news of septic abortion deaths in IUD users led to withdrawal from the market of the Dalkon Shield, a device that appeared at the time to be particularly associated with such deaths (154). Reanalysis of the data by the CDC has shown the Dalkon Shield to have had about three times the risks of other devices — a less dramatic difference than was first suspected (33). Attention focused on the Dalkon Shield may have obscured the fact that septic abortion, with risk of death, apparently can occur with any IUD. For example, cases of nonfatal septic abortion in users of copper devices have recently been

Table 16. Ratios of Ectopic to Uterine Pregnancies in IUD Users and in National and Hospital Populations, Selected Studies, 1968-1978

Author & Date	Ref. No.	Device/ Location	No. of Ectopic Pregnancies	Ratio Ectopic/ Uterine (%)
IUD USERS				
Alza Corporation 1976	13	Progestasert/ North America	17	21
Hallatt 1976	93	Not specified/Los Angeles (USA)	15	5.5
Jain 1977	119	Lippes Loop/ Taichung, Taiwan	3 ⩽ 1 year: 5 1-3 years: 5 ⩾ 3 years: 13 all:	0.78 1.30 3.97 1.45
Snowden et al. 1977	285	Various/ Britain	25	5.4
Steven & Fraser 1974	300	Various/ Edinburgh, Scotland	4	4.9
Tatum & Schmidt 1977	312	TCu-200/ US & Canada	5 ⩽ 1 year: 5 1-2 years: 4 ⩾ 2 years: 14 all:	1.6 3.0 7.3 2.6
Tietze & Lewit 1970	323	Unmedicated/ international, mostly US	34	4.3
Vessey et al. 1974	342	Various, mostly Lippes Loop & Saf-T-Coil/Britain	1 ⩽ 2 years: 1 2-4 years: 6 ⩾ 4 years: 8 all:	2.6 3.6 26.1 8.9
Virkar & Parulkar 1974	346	Soonawala & Antigon/ Bombay, India	2	4.1
Wei 1968	353	Ring & Lippes Loop/Taiwan	35	7.7
NATIONAL AND HOSPITAL POPULATIONS				
Erkkola & Liukko 1977	55	Turku, Finland, 1966-75	345	0.60-1.08
Helvacioglu et al. 1979	108	Chicago, USA, 1968-75	313	1.4
Kallenberger et al. 1978	131	Oklahoma City, USA, 1960-75	947	0.5
Lehfeldt et al. 1970	152	USA, 1967	4,154	0.51
Rantakylä et al. 1977	231	Oulu, Finland, 1972-74	71	0.78
Savolainen & Saksela 1978	253	Helsinki, Finland, 1968-74	988	1.3-2.5
Tatum & Schmidt 1977	312	New York, USA, 1970-74 whites: nonwhites:	 391 764	 0.30 0.67

reported (313, 344). Removing the IUD as soon as pregnancy is detected appears to eliminate the risk; in the 17 months after the USFDA and the manufacturer of the Dalkon Shield instructed doctors to remove IUDs from women who became pregnant, no septic abortion deaths of IUD users were reported (33).

Ectopic Pregnancy

Ectopic pregnancy — occurring when a fertilized ovum implants outside the uterus, in the oviducts, ovaries, or abdomen — is a life-threatening condition that demands surgery as soon as it is detected. In the US and Britain ectopic pregnancy accounts for about 10 percent of maternal deaths, a percentage that has risen recently as rates of maternal mortality generally have declined faster than death rates for ectopic pregnancy (23, 256). In developing countries, the scarcity of emergency surgical care makes the condition more dangerous than in developed countries. Mortality rates in developing countries may therefore be considerably higher than the estimated two to four per 1,000 cases in the US and Great Britain (23, 108, 256).

When a pregnancy occurs in an IUD user, the chances that it is ectopic are greater than for a non-IUD user. In studies of IUD users the proportion of pregnancies that are ectopic has varied from less than 1 to more than 25 percent. Most are in the range of 1 to 5 percent (see Table 16). By comparison, in studies comparing ectopic pregnancies to deliveries in hospital the highest proportion is about 4 percent of all deliveries, reported from Taiwan (353) and Jamaica (214). Most research in the US, Finland, and Britain has found proportions near or below 1 percent (23, 55, 108, 131, 231, 312). For an IUD user, the chances that a pregnancy will be ectopic have been roughly estimated to be 7 to 10 times higher than for a nonuser, or approximately one in 30 as compared with one in 250 pregnancies of non-IUD users (21, 181, 215, 217).

The greater likelihood that an IUD user's pregnancy will be ectopic requires that health personnel be alert to the possibility of ectopic pregnancy and also warn women using IUDs. Careful diagnosis is especially important because the symptoms of ectopic pregnancy — abdominal pain, heavy bleeding, and amenorrhea — are often attributed initially to the IUD itself. In one US series of 70 ectopic pregnancies in IUD users, 85 percent were misdiagnosed on the first visit (93).

The higher ratio of ectopic to uterine pregnancies in IUD users could be explained in two ways: either (1) IUDs do not prevent ectopic pregnancy as well as they prevent uterine pregnancy (152, 323) or (2) IUD-related inflammation or infection in the tubes interferes with the movement of the fertilized ovum, making ectopic pregnancy more likely (312). While these hypotheses are not mutually exclusive, the relative roles they might play would affect the incidence of ectopic pregnancy in IUD users.

Reliable comparisons of the incidence of ectopic pregnancy in IUD users and nonusers cannot be made with the data now available. The ideal study — a large-scale cohort study of IUD users and nonusers, with pregnancies reported in life table format — has not been published (18). Some researchers have reported the number of ectopic pregnancies per 1,000 woman-years of IUD use. These rates range from less than one to four (see Table 17). Difficulties in identifying proper comparison groups make the meaning of these rates uncertain. Studies that compare ectopic pregnancy rates in IUD users

with rates in other populations run the chance of selecting a comparison group that differs from the IUD users in ways that affect the risk of ectopic pregnancy (18). For example, risk of ectopic pregnancy rises with age and is higher for women with a history of ectopic pregnancy or of pelvic infection (65, 108, 131, 253, 257, 301, 312). In some countries, ratios of ectopic to uterine pregnancies are lower in whites than in nonwhites (312, 339). Furthermore, in Britain, Finland, the US, and Sweden, ectopic pregnancy rates have risen rapidly over the past several decades (23, 253, 273, 355). All these factors must be taken into account when choosing a comparison group.

Until recently the consensus was that IUDs simply fail to provide as much protection against ectopic pregnancy as they do against uterine pregnancy (57, 152, 323). Hans Lehfeldt and colleagues estimated in 1970 that IUDs reduced uterine implantations by 99.5 percent, tubal implantations by 95 percent, and ovarian implantations not at all (152). A Finnish study has reached a similar conclusion (253). The hypothesis is biologically plausible because the IUD is a locally acting device, and its effect, therefore, may not always extend to the oviducts.

The Lehfeldt-Tietze hypothesis has recently been challenged by Howard Tatum and Frederick Schmidt (312) on the basis of data showing an increase in the ratio of ectopic to uterine pregnancies with increasing duration of IUD use in three studies (119, 313, 342). This duration of use effect would suggest a causal relationship between IUDs and ectopic pregnancy. However, because uterine pregnancy rates decline with duration of IUD use while at the same time the risk of ectopic pregnancy increases with age, ratios of ectopic to uterine pregnancies would be expected to increase over time in any case. As a result, these data are difficult to interpret.

Two studies of ectopic pregnancy rates expressed in ways unrelated to uterine pregnancy rates offer stronger evidence of a duration-of-use effect. Irving Sivin, in a report of life table rates of ectopic pregnancy in copper T users, found a significant increase between the second and third years of use, although there was little change between the first and second or third and fourth years (273). Similarly, the Alza Corporation's study of the Progestasert showed an increasing rate of ectopic pregnancy over a year's time — 2.43 per 1,000 woman-years in the first six months and 5.05 in the last six months (13). Even in these instances, however, the apparent duration-of-use effect cannot be considered clear evidence for a cause-and-effect relationship because the highly fertile will become pregnant early in the study, leaving an increasing proportion of subfertile women and women with chronic pelvic inflammatory disease, who may be at greater risk of ectopic pregnancy (242).

Sivin has compared the rate of ectopic pregnancies in users of unmedicated IUDs as reported in the CSP — 1.188 per 1,000 woman-years — with rates for US women in general calculated from the data of the US National Hospital Discharge Survey. These rates range from 0.38 per 1,000 women aged 15 to 44 in 1965 to 0.83 in 1977. The difference from the CSP rate, Sivin reports, is attributable to the proportion of the population that is at little or no risk of ectopic (or uterine) pregnancy; eliminating these women from consideration, he estimates that the rate of ectopic pregnancy in IUD users is close to that in women using traditional methods or no method at all. The implication is that the IUD offers little if any protection against ectopic pregnancy but neither is it a substantial cause of ectopic pregnancy. While noting that his data, which include the apparent duration-of-use effect for copper T users, "do not necessarily

Table 17. Ectopic Pregnancy and IUD Use, as Measured by Life Table and Pearl Formula Techniques, Selected Studies, 1976-1979

Author & Date	Ref. No.	Contraceptive Method	No. of Ectopic Pregnancies	Rate
LIFE TABLE				**(per 1,000 women)**
Alza Corporation 1976	13	Progestasert	17	At 1 year: 3.7
Sivin 1979	273	TCu		At 1 year: 0.63 At 2 years: 1.11 At 3 years: 3.09 At 4 years: 3.68
PEARL FORMULA				**(per 1,000 woman-years)**
Alza Corporation 1976	13	Progestasert	17	3.4
Barron et al. 1979	21	Lippes Loop C & D	2	0.7
Sivin 1979	273	TCu	28	0.74 Adequate follow-up only: 0.96
		(All US women aged 15-44)		Estimated: 1965: 0.38 1973: 0.57 1976: 0.72
		Traditional methods & none		Estimated: 1965: 0.68-0.72 1973: 1.15-1.25 1976: 1.53-1.63
Snowden 1977	283	TCu & Cu-7	2	0.6
USFDA 1979	334	Unmedicated		1.2
		TCu		0.5
		Cu-7		0.4
		Progestasert		4.0
Vessey et al. 1976	341	Various IUDs, mostly Lippes Loop & Saf-T-Coil	8	0.82
		OCs	0	—
		Diaphragm	0	—
		Other & none	3	0.34
Weström 1979	355	Various IUDs		4
		None		4

constitute a clean bill of health for the IUD," Sivin concludes that, "The IUD could not have been a major factor contributing to the recent doubling in the rate of ectopic pregnancy in the U.S." (273). With less than 10 percent of US women of reproductive age using IUDs (62), clearly other factors are chiefly responsible for the rising incidence of ectopic pregnancy.

Comparative data for the period 1968 to 1975 were collected in the Oxford/Family Planning Association study of over 17,000 British women using various contraceptive methods. Eight ectopic pregnancies occurred in 9,768 woman-years of IUD use, for a rate of 0.82 per 1,000 woman-years. There were no ectopic pregnancies in 22,955 woman-years of oral contraceptive use or in 11,481 woman-years of diaphragm use. Three ectopic pregnancies occurred in 8,744 woman-years of follow-up of women using other contraceptive methods or no method at all, for a rate of 0.34 per 1,000 woman-years (341).

Another important study, covering all pregnancies in the Swedish city of Lund from 1960 to 1977, shows a threefold increase in ectopic pregnancies, from 0.57 per thousand women aged 15-39 in 1960-64 to 1.42 per thousand in 1975-77. Even though ectopic pregnancy is normally more common among older women, during the latter period the rates for women aged 20-29 exceeded those for women aged 30-39.

Table 18. Annual Incidence of Ectopic Pregnancy per Thousand Women in Lund, Sweden, 1960-64 and 1975-77

	1960-64	1975-77
Women aged 20-29	0.63	1.76
Women aged 30-39	0.77	1.42

Source: Weström (355)

Lars Weström attributes some of this rise in ectopic pregnancy to the increased prevalence of IUD use — from 40 to 126 per thousand women aged 20-29 between 1970 and 1975 — and to a substantial increase in pelvic inflammatory disease. Comparing ectopic pregnancy rates in IUD users and in sexually active users of no contraception between 1965 and 1977, he found the rates identical — 4 per thousand woman-years (355).

While the epidemiologic data are uncertain, the hypothesis that IUDs increase the incidence of ectopic pregnancy is plausible. IUDs are known to be related to an increased incidence of pelvic inflammatory disease (see p. B-67), which could affect the tissue of the oviducts (312). A history of pelvic infection is common in women with ectopic pregnancies (93, 131, 350) and has long been considered an important risk factor (49, 65). The relationship between PID and ectopic pregnancy is difficult to quantify, however, because PID is so often asymptomatic (351). The best data come from Weström, who reported 19 ectopic pregnancies in 412 women studied 6 to 14 years after laparoscopically verified diagnosis of PID. Almost 4.2 percent of pregnancies in this group were ectopic, compared with only 0.7 percent in a group of 282 women of comparable age and parity who, when examined via laparoscope, had showed no signs of PID (356). While lower rates of reported PID have been seen in IUD users who developed ectopic pregnancies than in nonusers (55, 93), this may be because women with a known history of infection are not likely to be provided with IUDs (55) and infections in IUD users may have been subclinical (350).

Questions have been raised about whether ectopic pregnancy rates differ among devices. In particular, the ectopic pregnancy rate reported by the manufacturers of the Progestasert has drawn attention (283, 334). Data submitted by the Alza Corporation to the USFDA show a rate of ectopic pregnancy of 4.0 per 1,000 woman-years in 126,800 woman-years of use (334). Alza researchers point out that comparisons of data on the Progestasert, gathered in the mid-1970s, with data on inert devices from the CSP, gathered in the 1960s (showing 1.2 ectopic pregnancies per 1,000 woman-years), neglect the secular rise in ectopic pregnancy rates in the US (217). Also, differences in duration of use in these and other IUD studies as well as differences in populations make comparisons among studies difficult to interpret. Nonetheless, the difference in rates (see Table 17) is large enough that the USFDA, in the January 1979 issue of its newsletter to health professionals, wrote, "FDA wants to alert medical professionals to evaluate carefully patients who become pregnant while wearing Progestasert IUD's, to determine whether or not the pregnancies are ectopic" (334). Higher than expected ectopic pregnancy rates have also been noted with the minipill, the progestin-only oral contraceptive (24, 27, 164, 281) (see **Population Reports**, Series A, Number 3, *Minipill – A Limited Alternative for Certain Women*, September 1975). It has been pointed out that both the Progestasert and the minipill derive their effectiveness from progestational hormonal action (67), but ectopic pregnancy rates for the Progestasert and for its plastic component without progesterone are similar (217).

The question has been raised whether ratios of ectopic to uterine pregnancy remain high after discontinuation of IUD use. This might be expected if the IUD had an effect on tubal tissue that lingered after the device was removed (312). Data on planned pregnancies in IUD users are few (255, 312, 341) and do not suggest rates of ectopic pregnancy outside the range of rates seen in large populations.

Overall, some evidence hints at a higher incidence of ectopic pregnancies in IUD users than in users of other contraceptives or of no contraceptives, but it is far from conclusive. Regardless of the resolution of this question, when a woman with an IUD becomes pregnant, the risk of an extrauterine pregnancy of between one and five per 100 pregnancies constitutes sufficient danger to warrant special attention.

Lactation

Evidence from both developed and developing countries confirms that breast milk is the most nutritious, economical, and appropriate food for infants. Breast-feeding has some effect in delaying ovulation but is not effective as a long-term contraceptive method. Therefore, lactating women need to use effective methods of family planning in order to avoid pregnancy and assure continued lactation until the desired weaning time. There is no evidence that IUDs in any way inhibit lactation or adversely affect the quality of breast milk. With regard to a possible positive effect of IUDs on lactation, data are conflicting. A few reports suggest that the IUD is associated with longer periods of lactation while others suggest that there is no cause-and-effect or biological link.

Some studies show that women with IUDs breast-feed longer than women who use other contraceptives. A 1967 study of 276 Chilean mothers showed that the average lactation period for women using an IUD was two months longer than for the same women during a previous period of lactation without an IUD, and that the average lactation period for IUD users was about twice as long as for women in the study who used oral contraceptives (386). Analysis of a cohort of 794 Philippine women who delivered in a hospital found that the average period of breast-feeding simultaneous with pill use was three months; with conventional contraceptives, seven months; and

The "Guidelines for Use of IUDs" which appears on the following pages can be detached from this issue of Population Reports and displayed on a wall.

GUIDELINES FOR USE OF IUDS

IUDs are a safe and effective method of family planning.

Estimated Event Rates at 12 Months:

pregnancy	**1-6 per 100 users**
expulsion	**5-20 per 100 users**
bleeding and pain removals	**5-15 per 100 users**
other medical removals	**3-9 per 100 users**
mortality	**0.0001-0.001 per 100 users**

These guidelines largely reflect the 1978 USFDA report. Further discussion of controversial points, recent findings, and causal mechanisms together with source references may be found in the text of Population Reports, Series B, Number 3, *IUDs — Update on Safety, Effectiveness, and Research,* May 1979.

Counseling

Before any IUD is inserted, the potential user should be counseled by and be able to ask questions of someone who:

- speaks her own language
- is sympathetic to her personal needs
- has time to provide all the information desired
- is well-informed about the IUD
- understands alternative family planning choices
- is candid but not alarming about possible problems including pregnancy, expulsion, pain, bleeding, and infection
- informs the user of the type of IUD to be inserted and the proper time for replacement if any active ingredients are included
- sets up a follow-up appointment if possible after 1 to 3 months
- tells the user where follow-up care is availabie.

Medical Contraindications

known or suspected pregnancy
pelvic infection
congenital uterine abnormalities
gonorrhea
severe cervicitis
abnormal pelvic bleeding
gynecological malignancy
endometritis
severe cervical stenosis
disorders of the blood or coagulopathy

Possible Contraindications

history of ectopic pregnancy
menstrual disorders

Timing of Insertion

IUDs may be inserted at the convenience of the user if it can be reasonably determined that she is not pregnant. During menstruation, after a pregnancy aborted before 12 weeks of gestation, and within the first week after delivery are appropriate times although special care should be taken with early postpartum and immediate postabortion insertions to insure proper placement of the device and to avoid perforation.

Insertion Technique

The safest rule is to follow meticulously the manufacturer's instructions. IUDs should be inserted high in the uterus with care to avoid perforation. IUDs and instruments inserted in the endocervical canal and/or uterus must be sterile. The following steps are recommended in the 1978 USFDA report for late menstrual insertion:

1. Administer analgesics and sedatives if needed. Use atropine if there is reason to expect syncope. Usually, IUD insertion involves brief discomfort rather than pain.
2. Insert a speculum into the vagina and inspect the cervix and vaginal walls.
3. Take a Papanicolaou smear, if possible, and a culture for gonorrhea. These are measures of preventive medical care and should not be prerequisites for IUD insertion.
4. Perform a bimanual examination to determine the size, shape, position, and mobility of the uterus and to rule out malignancy or inflammation of adjoining organs.
5. Reinsert the speculum and swab the endocervix and vaginal walls with an antiseptic solution.
6. Use intracervical anesthesia or a paracervical block at this time, if necessary. This may be helpful for women who have never been pregnant, women with cervical stenosis, or women who may experience syncope.
7. Place a tenaculum on the cervix and apply gentle traction to correct uterine flexion and stabilize the uterus. This will minimize bleeding and perforation.
8. Insert a uterine sound to determine the condition of the endocervical canal and the internal os and the position and depth of the uterus. If the uterus is smaller than 6.0 to 6.5 cm in depth, a smaller than standard IUD should be considered.
9. Insert the IUD following manufacturer's instructions, high into the uterine fundus, with only the thread remaining in the endocervical canal.

Syncope

Syncope, a sudden suspension of circulation and respiration, may occur in some women during insertion. To prevent syncopal attacks in women prone to vasovagal reactions, atropine may be administered intravenously or mild sedatives and local anesthesia used. Inhalation of spirits of ammonia and rest in a horizontal position is the usual treatment for mild syncope.

Expulsion

Expulsion, either noticed or unnoticed, full or partial, may occur at any time but is most common during the first postinsertion menses. Every user should be shown how to check for the presence of the tail or thread after each menstrual period to be sure the IUD is in place and told to return to the provider for a check-up if the tail cannot be located. More than half the women who expel IUDs will retain them if they are reinserted.

Complications

Perforation occurs in less than one-tenth of one percent of users, almost always at the time of insertion, when it may be accompanied by sudden pain and/or bleeding. Asymptomatic perforation may be noted at any time. If perforation is suspected, it is first essential to determine whether the woman is pregnant. If not, the uterus should be probed. Posterior and lateral x-rays or insertion of a second IUD to locate the uterus, by x-ray, may be used, but ultrasonography is preferable for a pregnant woman.

Closed devices that have perforated the uterus should be removed immediately to prevent possible bowel strangulation. Devices containing copper should be removed as soon as possible to prevent growth of intraperitoneal adhesions. Medical opinion differs as to the need to remove linear devices, which may in some cases cause intestinal obstruction but usually do no harm.

Laparoscopy, colpotomy, or culdoscopy may be used to locate and remove a perforating IUD. Laparotomy may be necessary if adhesions have formed and endoscopic instruments are not available.

Embedding. If the IUD is known to be deeply embedded in the endometrium or the myometrium, it should be removed (see **IUD Removal** below).

Bleeding and Pain. These common symptoms are the major medical reasons women discontinue IUD use. Spotting occurs in many users. An increase in menstrual blood loss is to be expected. With unmedicated IUDs, average blood loss is about twice as high as in previous cycles. With copper IUDs, blood loss is about 50 percent higher than previously. With progesterone-releasing IUDs, menstrual blood loss is less than in previous cycles, but spotting and midcycle bleeding are more frequent. Bleeding and cramps may seem to be heaviest in the first three months. Family planning providers should reassure and encourage users; analgesics may be given for cramping and antifibrinolytic agents have been used in some cases to limit heavy bleeding. Sympathetic attention may be as effective as any medication tested to date in encouraging continuation. If heavy bleeding and discomfort continue, the user is likely to want the IUD removed and will need advice on alternative methods.

Infection. Pelvic inflammatory disease (PID) and other forms of infection occur more frequently in IUD users than in nonusers. This may be a special problem for young nulliparous women. The usual symptoms are vaginal discharge, pelvic pain or tenderness, abnormal bleeding, chills, and fever. A broad-spectrum antibiotic effective against gonorrhea should be used against PID. If this treatment does not provide relief in 24 to 48 hours, the device should be removed. If pelvic abscesses or peritonitis develops, intensive antibiotic therapy should be provided at once, changing medication if necessary and taking account of the possibility of anaerobic bacteria.

Pregnancy occurs in 1 to 6 per hundred IUD users per year, making IUDs second only to sterilization and oral contraceptives as a highly effective modern method of contraception. While many women have successfully completed pregnancy with an IUD in situ, the risks of spontaneous abortion and septic midtrimester abortion are greater if the IUD remains in place. If the user wishes to continue an intrauterine pregnancy, an attempt should be made to remove the device with as little disturbance to the uterus as possible. If the device cannot be easily removed, the user should be warned that a hazardous septic midterm abortion may occur. This can begin with mild generalized flu symptoms, but, without immediate medical attention, it can be serious and even fatal.

Ectopic Pregnancy. If pregnancy does occur in an IUD user it is about ten times more likely to be an ectopic pregnancy than would be the case for a nonuser. Health care providers should be aware of this possibility. Women who experience the symptoms of ectopic pregnancy — abdominal pain, heavy nonmenstrual bleeding, and amenorrhea — should seek help immediately.

Medical Indications for IUD Removal

- pelvic pain and/or cramping
- abnormal or excessive bleeding
- acute pelvic inflammatory disease that does not respond to antibiotics
- displacement of IUD from uterus
- pregnancy, if removal can be accomplished without penetrating the uterine cavity
- uterine or cervical malignancy
- menopause

IUD Removal

If the tail or thread is visible, removal is usually simple. As at IUD insertion in a menstruating woman, the uterus should be examined bimanually and a speculum introduced to visualize the cervix. The tail or two threads of the IUD should be grasped with fingers or forceps and steady traction applied. If necessary, a tenaculum may be placed on the cervix to straighten the cervico-uterine angle.

If the tail or thread is not readily accessible, the cervix should be cleansed with antiseptic solution and the endocervix probed to locate the tail. Paracervical block, intracervical anesthesia, or prior use of laminaria may be necessary. As with insertion, a tenaculum may be needed to ease access and stabilize the uterus. Special instruments for IUD removal or other grasping instruments may also be used to probe for and extract the IUD. Aspiration of the uterus with a vacuum curette has also been used to retrieve threads retracted into the uterus. If these efforts are not successful, additional diagnostic measures such as sonograms and hysterograms are needed to be sure the IUD is in utero.

Follow-up Care

Women should be reexamined if possible within three months after IUD insertion. Annual checks are useful to be sure the device is still in place.

If threads are visible and the device appears to be in the uterine cavity, the thread should not be pulled. Medicated devices should be replaced at the recommended intervals. Women who have passed menopause should have devices removed since removal becomes more difficult after six months.

The "Guidelines for Use of IUDs" which appears on the preceeding pages can be detached from this issue of Population Reports and displayed on a wall.

with IUDs, nine months (396). In the same study, lactation continuation rates at one year, figured by the life table method, were 27 percent for pill users, 38 percent for noncontraceptors, and 42 percent for IUD users. Whether the IUD was responsible for longer lactation periods or, alternatively, women planning to nurse their infants for longer periods selected IUDs initially is not clear.

Biologically, no cause-and-effect link has been found between IUD use and lactation. In Cairo, Hefnawi and colleagues analyzed the amount and biochemical composition of breast milk from 150 women using Lippes Loops during the first year postpartum. When compared with normal lactation periods as determined by Hefnawi's earlier study of other Egyptian women, neither the amount nor the composition of milk appeared significantly affected by the IUDs (389).

Several studies have noted an increase in serum prolactin (the hormone responsible for the initiation of lactatogenesis) during IUD use (391, 395). A recent US investigation, however, found mean serum prolactin values for both short-term and long-term IUD users to be within the normal range; both unmedicated and copper IUDs were used in this study (399). Lactation was studied in a group of 185 Indian women who received a Lippes Loop postpartum (390). Compared with a group of 106 postpartum women without IUDs, the difference in duration of lactation was not statistically significant, nor was lactational amenorrhea affected by the IUD insertions.

In a US study, William Spellacy looked at the effects of progesterone-releasing IUDs on prolactin levels. Twenty-six women were tested before the insertion of a Progestasert and again at six- and twelve-month intervals. There were no significant differences in prolactin levels at the three times of testing (398). These results suggest that a progesterone-releasing IUD, like the other devices, has no effect on breastfeeding.

Subsequent Fertility

While it has been generally accepted and demonstrated that IUD use does not affect subsequent fertility (265, 323), a review of 2,536 users of Lippes Loops in Taiwan has raised anew the possibility that the longer a woman uses an IUD, the less her chances relative to nonusers of the same age group of conceiving after she discontinues the method (121). Among women over 35 the estimated proportion who failed to conceive within 36 months after discontinuation was three times as high among women using IUDs for less than one year. The authors hypothesized that pelvic inflammatory disease might be responsible and that this could also explain why rates of accidental pregnancy decrease with duration of IUD use (121).

While an effect of IUDs on subsequent fertility is not implausible, given the association between IUD use and pelvic inflammatory disease, these findings have yet to be confirmed. In Britain, in a smaller group of women, 48.5 percent of 258 who had their devices removed in order to become pregnant had not given birth after 12 months as compared with 29.4 percent of 1,085 women abandoning diaphragms or other traditional contraceptive methods. After 3½ years, however, only 1 former IUD user (0.4 percent) and 13 other women (0.8 percent) had not given birth. The average age in both groups of women was slightly over 30 (343). These figures suggest that some IUD users were slow to recover their fertility, but virtually all did so eventually. The effect on subsequent fertility of specific types of IUDs, as well as that of IUDs generally, deserves further study.

EVALUATION AND RESEARCH

Intrauterine devices are relatively easy to design, inexpensive to manufacture, and much less stringently regulated than drugs. As a result dozens of different models and configurations are in use throughout the world, many still being tested by individual developers. Some of the devices most widely known and utilized today are illustrated and described on pages B-86–B-89: the Lippes Loop, Saf-T-Coil, Cu-7 (Gravigard, TCu-200, TCu-220, TCu-380Ag, Multiload-cu250, Nova T, the Shanghai V, the Dana, and the Ohta Ring. Many other devices, including the Antigon, Birnberg Bow, Dalkon Shield, Spring Coil, M-shaped device with and without springs, intrauterine membranes, the Anderson leaf, and spirals, as illustrated in **Population Reports**, Series B, Number 2, IUDs *Reassessed — A Decade of Experience*, January 1975, have also been used, often in different sizes. Slight permutations of some designs are also being tested as carriers of active pharmacologic agents.

During the 1960s and early 1970s, the primary objective of IUD research was a better understanding of the mode of action of IUDs in order to provide a rational basis for improving their essential function — the prevention of pregnancy. Less emphasis was given to minimizing the incidence of side effects, such as expulsion or bleeding. Today, the emphasis is exactly the reverse (377). Preventing side effects which cause discontinuation — such as expulsion and bleeding — is the main challenge to IUD design (295).

Research activities involving IUDs today can be described in four different but overlapping categories:

- evaluation of performance characteristics of devices now in use with special attention to rare events or serious complications such as ectopic pregnancy and acute infection
- clinical testing of experimental designs, especially those containing active ingredients such as metallic salts, steroidal hormones, and antifibrinolytic agents, to determine the optimal amount and effective life of the active agents
- improvement of insertion techniques, measuring devices, and inserters to assure better fit and placement of devices within the uterus
- development and clinical testing of devices with biodegradable retentive components to reduce expulsion after postpartum or postabortal insertion.

As Table 19 shows, this research in IUDs is being conducted primarily by national and international governmental or nonprofit agencies. Since the financial returns to a commercial firm are small in developing and marketing simple plastic devices that may last ten years or longer, IUD research and development has been funded mainly by governments and foundations and carried out by individual clinicians and private nonprofit organizations. Only in the field of hormone-releasing IUDs has a commercial firm made a substantial contribution to research.

Evaluation of IUD performance characteristics which was initiated by the Population Council in 1962 is now carried out not only by the Council and its International Committee on Contraceptive Research but also by the International Fertility Research Program (IFRP), the United Kingdom IUD Research

Table 19. Major Current Research Programs Involving Intrauterine Devices

Organization	Ref. No.	Technology Being Tested	Purpose of Research	Location	Source of Funding	Approximate Annual Funding Level, 1978-1979
Alza Corporation (commercial firm)	13, 217	Progestasert IUD	To extend proven effective life of IUD beyond 12 months.	US	Own funds	NA
			To test devices carrying more than 38 mg of progesterone.	Mexico		
			To show decreased menstrual blood loss and cramping in US as shown in earlier European studies.	US		
			To test prophylactic value for women approaching menopause and/or with endometrial hyperplasia.			
Center for Population Research (government agency)	338	estriol-releasing T device	To determine whether estriol has a contraceptive effect within the uterus by binding to estrogen receptors and altering normal uterine cycle.	US	USNIH	$100,000-$200,000
		IUDs currently in use in the USA	To determine whether IUD use is associated with increased risk of hospitalization for serious gynecological and obstetric disorders, e.g., uterine perforation, pelvic inflammatory disease, vaginal hemorrhage, spontaneous fetal loss, ectopic pregnancy, abruptio placenta, and placenta previa.	US	USNIH	$500,000
			To determine risk ratios, severity of these conditions, and certainty of diagnosis with IUDs now in use (9 center case-comparison study).			
International Committee for Applied Research in Population (ICARP) (private nonprofit organization)	53, 191	TCu-380Ag	To test efficacy and safety of insertion after menstrual regulation by traditional healers.	India		$5,000
		Lippes Loop	To test efficacy and safety of post-abortal insertion.	Brazil		$5,000
International Fertility Research Program (IFRP) (private nonprofit organization)	147, 150, 223, 359	Lippes Loop TCu-220 Multiload others	To develop a) IUDs that will not be expelled if inserted in the immediate postpartum period, by adding biodegradable sutures to the Lippes Loop D and TCu IUDs to help hold the devices in place during involution and b) IUDs that slowly release trasylol or tranexamic acid (AMCA) into the uterine cavity to reduce IUD-related bleeding (using Lippes Loop D).	worldwide	USAID	$200,000-$300,000
			To conduct Phase III clinical trials to evaluate a) the performance of the sutured postpartum devices (rates of expulsion, removals for medical reasons, and infection), the optimal technique of postpartum insertion (hand versus inserter), and the best time for postpartum insertion (less than 10 minutes versus 2-36 hours postplacental); b) the effect of IUDs containing trasylol or tranexamic acid on menstrual blood loss, and c) other IUDs ready for Phase III testing such as the Nylon-wound T, the Population Council Postpartum T and TCu-380Ag, the Multiload, and the Alza Progestasert.			

Table 19 (Continued)

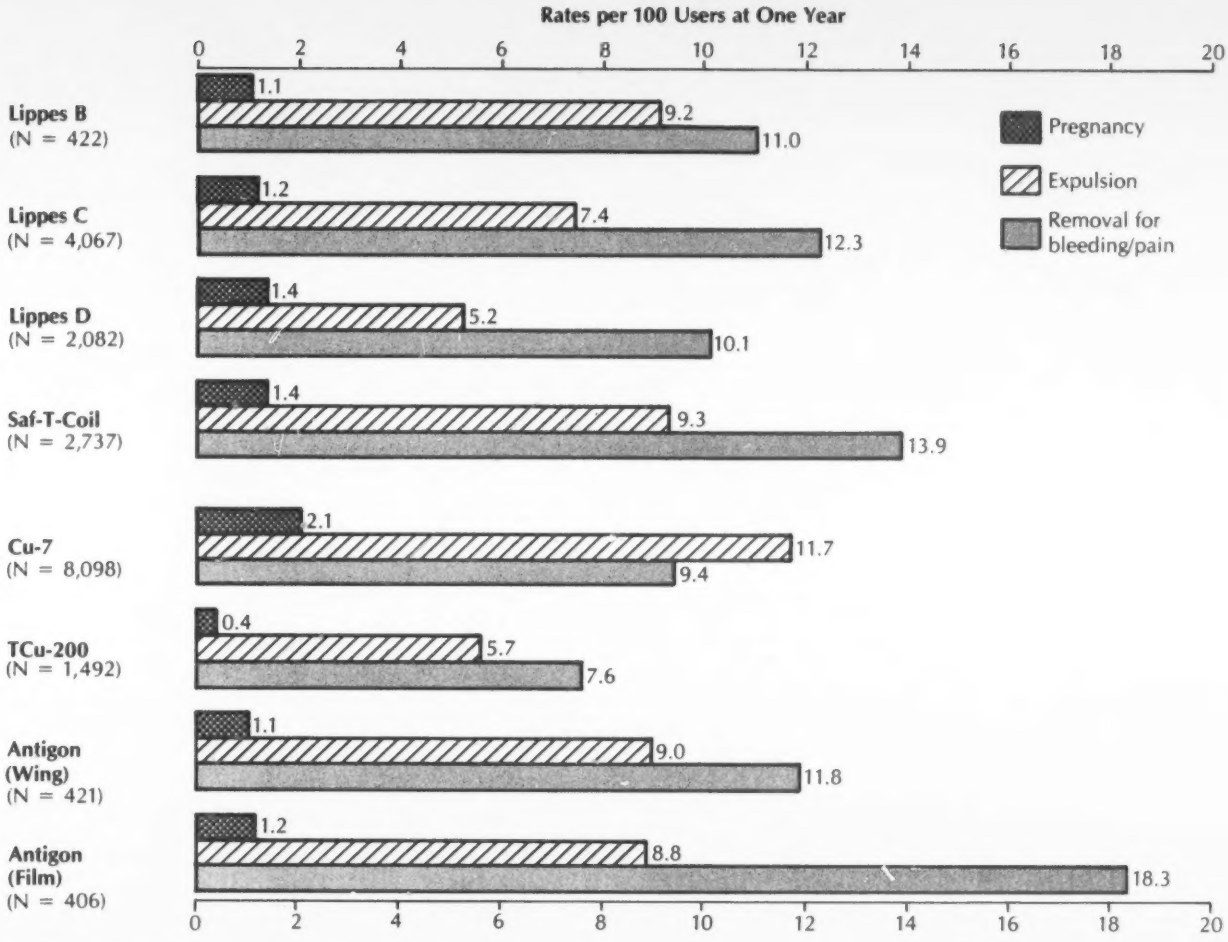
Population Council (private nonprofit organization)	191, 271	TCu-200 TCu-220 C TCu-380Ag	To determine effective life of medicated devices.		AID; UNFPA; other donors	$100,000
			To investigate use of a silver core for copper wire in TCu-380Ag.			
			To extend effective life by preventing fragmentation.			
			To investigate various safety aspects.			
			To investigate device releasing 10, 20, and 30 μg of norgestrel daily.	Finland		
Program for the Introduction and Adaptation of Contraceptive Technology (PIACT) (private nonprofit organization)	47, 187	Hasson Wing Sound & Uterine Metrology Device	To test whether uterine measurements can be used to identify women who are poor risks (a) using Hasson Wing Sound (for vertical measurement) and (b) using Uterine Metrology Device (for vertical and horizontal measurement).	Indonesia	UNFPA Ford	$30,000
			To test differences in insertions by MDs and paramedical personnel.	Mexico		
		Inserter	To test low-cost, reusable, flexible postpartum inserter for T-shaped IUDs and modified version for Lippes Loop, compared with hand or forceps insertion.	Mexico		
		Lippes Loop and copper devices	To study insertion immediately postpartum.	Mexico		
World Health Organization (WHO) (intergovernmental agency)	242, 368	Lippes D Cu-7 TCu-220	To test efficacy and safety of 3 IUDs inserted in multiparous women at the time of menses or immediately after (9 center randomized study).	Egypt, F.R. Germany, Hungary, India, Philippines, Thailand, UK, US, USSR	WHO	$300,000
			To study risk of pelvic inflammatory disease and ectopic pregnancy in IUD users (12 center case-comparison study).	Canada, Chile, Hungary, India, Korea, Nigeria, Philippines, Sweden, Thailand, UK		
			To study effect of IUDs and other fertility control methods on bacterial flora in the oviducts (12 center cohort study).	Canada, Chile, Colombia, Cuba, Korea, New Zealand, Singapore, Thailand, UK		
			To study extent and effects of uterine blood loss associated with IUDs.	Chile, Japan, Korea, Mexico, Sweden, UK		
		levonorgestrel IUD	To develop and test clinically an IUD releasing 2 μg or less daily of levonorgestrel with an effective life of at least 10 years and 50% reduction in menstrual blood loss.	Chile, Hungary, India, Korea, Mexico, Philippines, Sweden, Thailand, UK, Yugoslavia		

Programme at Exeter University, and the World Health Organization (WHO). Data are gathered from many centers using the same research protocols and pooled as appropriate for analysis.

As Table 11 and Figures 5 and 6 show, the differences in event rates among different centers or networks are almost as great as the differences among devices. Overall, the Lippes Loop D has lower termination rates than the other unmedicated devices while the TCu-200 has somewhat lower termination rates than the Lippes Loop. In the Exeter study, for example, the copper devices do not differ greatly from the Loops in pregnancy and expulsion rates, but they do show lower rates of removal for bleeding and pain (see Figure 5).

Recent Population Council studies have compared the TCu-200, which is now licensed for use in the US, with the TCu-220 and the TCu-380, both experimental devices (see Table 20). Unlike the TCu-200, which has copper wire only on the vertical arm, the TCu-220 has 7 copper sleeves, 5 on the vertical arm and one on each of the transverse arms. The TCu-380 has a copper sleeve on each of the transverse arms and a copper wire wrapped around the vertical arm. The positioning of the copper at the top of the device, resting in the fundus of the uterus, is believed to be the main reason for the lower pregnancy rates with the TCu-220 and 380 (see Figures 14, 15). The Population Council finds the TCu-380 somewhat easier to manufacture than the TCu-220. Also, based on data still unpublished, it has a slightly better performance record than the TCu-220. The Council has therefore decided to concentrate on the TCu-380 as its second-generation copper device rather than the TCu-220, even though the 220 has been more widely used (191).

Figure 5. One-year Net Event Rates After First Fittings, United Kingdom IUD Research Programme, 1972-1976



Note: Differences reflect differences in patient populations as well as in devices.

Source: Snowden et al. (285)

The World Health Organization has also been investigating various IUDs in international trials. WHO researchers are concerned about higher rates of removal for bleeding among the Lippes Loop users in their data. Since women in developing countries are often anemic and this anemia is aggravated by heavy menstrual bleeding, WHO is recommending that the TCu-220 be considered an alternative for women who experience problems with the Lippes Loop (242, 367).

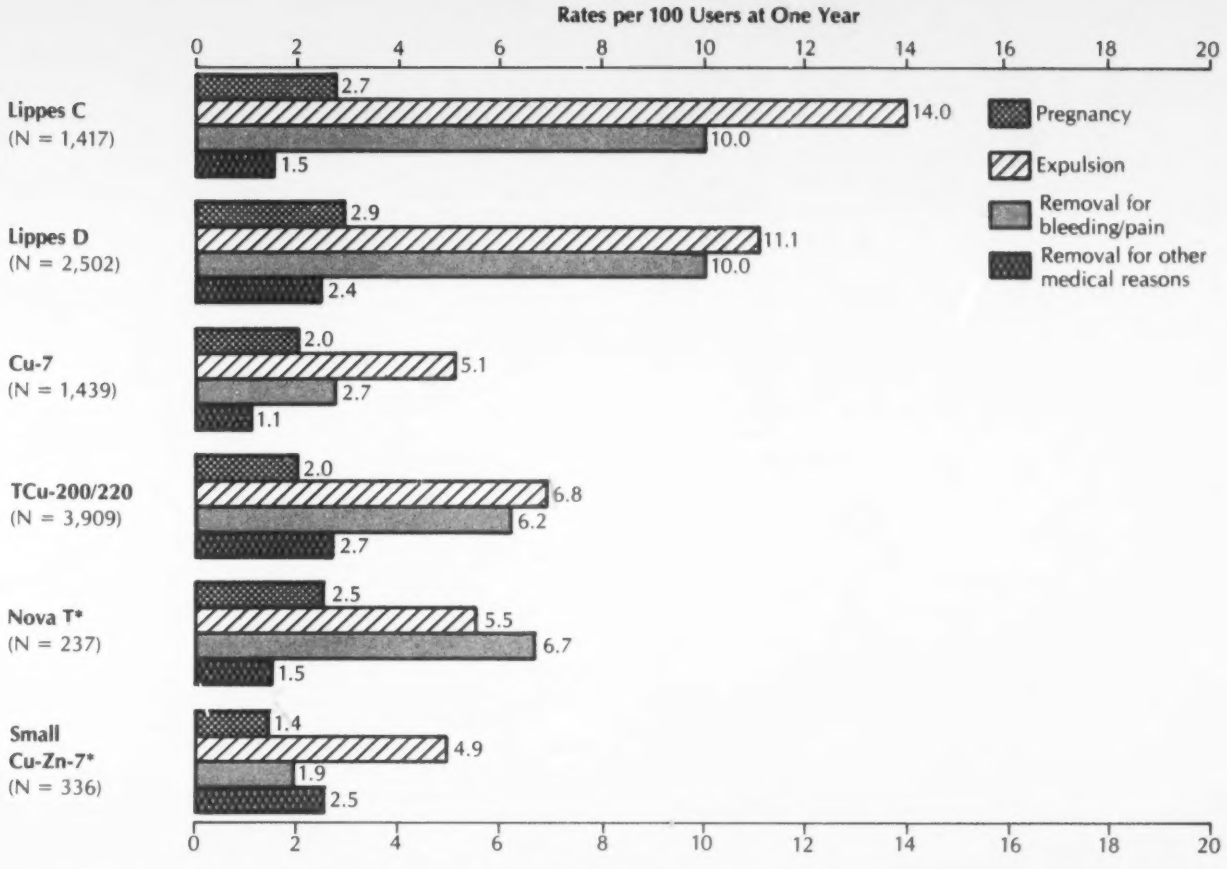
Meanwhile, data are being gathered by WHO in more than a dozen countries and by the Center for Population Research of the National Institutes of Health in the United States to investigate the extent to which IUD use may be associated with such serious conditions as uterine perforation, infection, ectopic pregnancy, or other gynecological and obstetric complications (338, 367). Results from these studies will be published beginning in 1979 and 1980.

Many observers believe that the development of unmedicated devices has gone as far as it can and that further efforts to produce new or improved configurations will not yield significant gains. Learning what pharmacologic agents to use, where on the device, in what quantities, with what release rates, and how long such medicated devices will remain fully effective now constitute a major element of IUD research.

Copper was the first active agent to be widely used. Zipper is experimenting with a copper-zinc combination which may effect electrolytic changes in the uterus (282), but most research with metals is focusing on the optimal amount and placement of copper. The TCu-200 and the Cu-7 are both licensed for marketing in the US with an approved lifetime of three years. The TCu-220C and the TCu-380A theoretically have longer life spans and the Population Council is gathering data to seek USFDA approval of the 380 for a longer period. A new version, tentatively called 380 Ag, includes 380 mg of copper wire with a silver core wrapped around the vertical arm of the T. The silver core is expected to prevent the copper from fragmenting and thus extend its life still further (271). A slightly different silver-cored copper wire device is now being manufactured in Finland as the Nova T (393) (see Table 20 and Figures 14-17).

In addition to copper, which acts primarily to enhance the existing contraceptive effect of the T- and 7-shaped devices, IUDs are also being used and tested as carriers for steroidal hormones. As recognized contraceptive agents, steroids within

Figure 6. One-year Gross Termination Rates per 100 Users, International Fertility Research Program Studies



*Single center trial

Note: Except for Nova T and small Cu-Zn-7, rates are adjusted for differences in age and parity among groups using different devices.

Source: International Fertility Research Program (114)

IUDs can be delivered locally in the uterus at substantially lower doses than required for oral administration and with minimal systemic side effects (219, 259). The Progestasert, developed by the Alza Corporation, is already in use. It contains a reservoir of 38 mg of progesterone in silicone oil and is approved by the USFDA with an effective life of one year. Alza is currently gathering data to extend this period to 18 months. A newer version manufactured in Mexico contains 52 mg of

Table 20. One-year First Segment Event Rates per 100 Users in Double Blind, Randomized, Multiclinic Comparisons of Copper Devices

	Sivin & Stern 1979 (278)				Jain 1975 (118)		Luukkainen et al. 1979 (167)	
	TCu-200	TCu-380A	TCu-200	TCu-220C	TCu-200	Cu-7	TCu-200	Nova T
Pregnancy	3.1	1.0	2.1	0.9	1.6	2.7	2.2	0.7
Expulsion	7.1	7.1	7.1	8.0	8.5	14.8	4.8	5.8
Removal								
Bleeding/Pain	11.5	14.2	10.3	11.5	8.1	10.2	13.9	12.3
Other Medical	2.8	3.0	3.6	2.3	3.3	4.0	4.8	4.6
Planning Pregnancy	2.2	2.4	0.9	1.9	1.5	1.7	2.1	2.9
Other Personal	2.4	2.4	3.4	1.9	2.7	1.8	0.4	1.2
Continuation	70.8	69.7	72.6	73.5	74.3	64.8	71.7	72.6
Insertions	1,851	1,679	1,014	1,097	1,775	1,762	936	907
Woman-months of Use	15,737	14,328	8,174	8,962	13,147	11,782	9,245	8,790

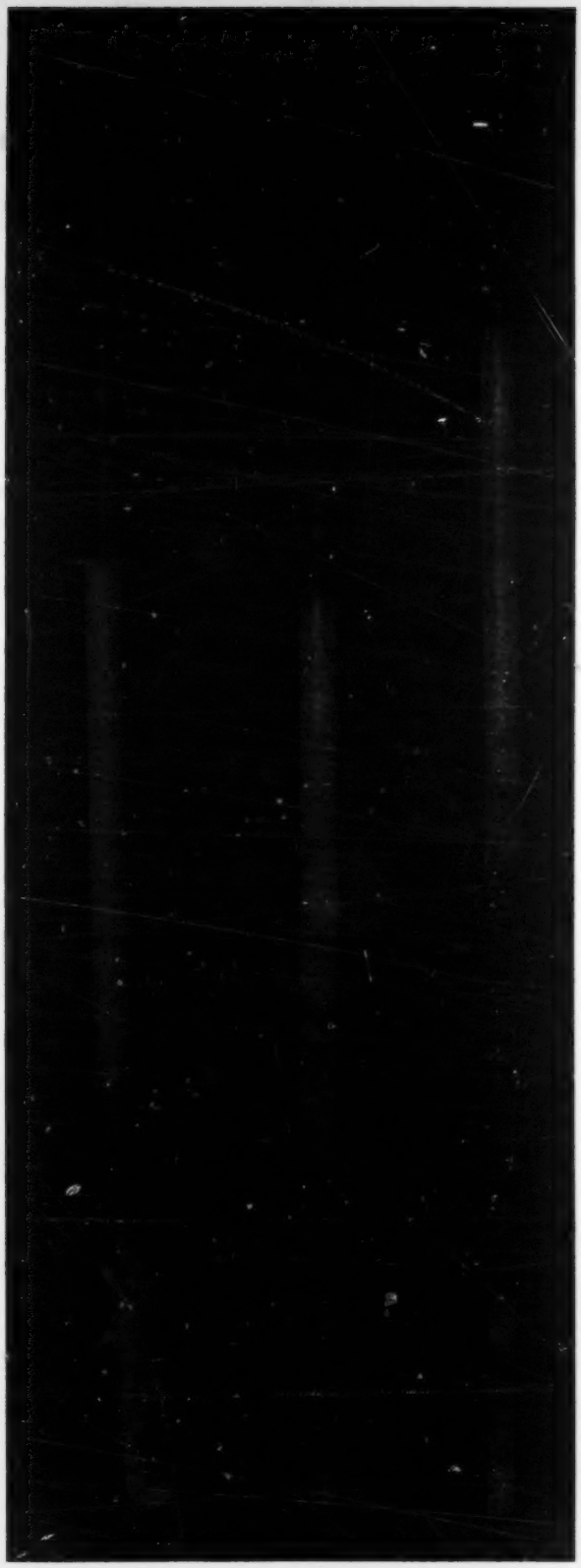


Figure 7. The Hasson Wing Sound permits precise measurements of the length of the uterine cavity from the internal os to the fundus separately from the length of the endocervical canal, thus making it possible for health care personnel to select and insert an IUD that exactly fits the uterine cavity and remains consistently above the cervix. (Photo courtesy of H.M. Hasson).

progesterone and is effective, according to Alza data, for three years. Other devices, believed to be effective for more than ten years, are also being tested (217).

The World Health Organization and the Population Council are both testing T-shaped devices that release levonorgestrel (formerly known as d-norgestrel), a synthetic progestin (168). The WHO device reportedly has a near constant release rate of 2 μg daily and an estimated minimum effective life span of 5 years, it is designed to produce a 40 to 60 percent reduction in menstrual blood loss (242). Clinical efficacy studies will begin in 1979 (242). The Population Council is testing devices with release rates of 10, 20, and 30 μg of levonorgestrel daily. Even these doses will not prevent ovulation but will act locally within the uterus (168, 191, 193, 194, 196). In these range-finding studies, Luukkainen will determine dose effects on bleeding control, suppression of the endometrium, and cervical mucus.

The Center for Population Research at the US National Institutes of Health is exploring possible use of an estrogen, estriol, on an intrauterine device. These studies have not yet reached the stage of clinical testing (338).

Another group of pharmacologic agents being added to IUDs are the fibrinolytic inhibitors tranexamic acid (AMCA) and epsilon aminocaproic acid (EACA). These synthetic amino acids have been used orally to reduce heavy menstrual bleeding (see p. B-66). M.I. Ragab and M.N. Thomas in Egypt showed that a U-Coil device releasing 4.3 μg of AMCA daily produced a removal rate for bleeding of 1.1 per 100 women as compared with 9.9 per 100 women with a U-Coil releasing copper (228). IFRP plans to support studies in a number of countries using trasylol- or AMCA-releasing devices to reduce bleeding (150).

Another important concern in current IUD research centers on the insertion process — measurement of uterine dimensions, selection of the appropriate size and shape device, and improved inserters, including those designed specifically for postpartum use. As M.F. Fathalla of Assiut University in Egypt points out:

> Marginal but significant advances in IUD performance can be achieved by improving either the insertion technique or the selection of patients. Too little effort has been spent on improving the inserter or on simplifying the insertion technique for use by paramedics and less experienced physicians. The development of a simple device to assess uterine size and configuration may go a long way in improving IUD performance, by screening out the potential problems (58).

H.M. Hasson has given special attention to the optimal size and shape of devices to fit the uterine cavity. He recommends an IUD design that (1) is shaped to remain stable in the fundus and resist downward force in the lower uterus; (2) avoids sharp edges or pointed tips that cause endometrial injury and bleeding; (3) combines transverse bend resilience with axial stiffness; and (4) is 1.25 to 1.75 cm smaller than the endometrial cavity. In a study of 319 women he found that combined pregnancy, expulsion, and medical removal rates were higher if the device was either too large, thus perforating or irritating uterine tissue, or too small, thus shifting position during uterine contractions (98, 99). Similarly, Ibrahim Kamal in Egypt has studied a large series of IUDs over long intervals using x-rays and a contrast medium to outline the uterus. His work too shows that pregnancies and side effects are more likely when the device fits the uterus poorly or does not cover the fundus adequately (132, 133, 206).

Some progress has been made in improving instrumentation for both uterine measurement and IUD insertion. The Hasson

Wing Sound, for example, provides a simple method of measuring the distance between the internal os and the fundus (99). Now being tested in Mexico is a Uterine Metrology Device developed by Battelle-Northwest for performing both lateral and longitudinal uterine measurements (47) (see Figures 7 and 8).

The Program for the Introduction and Adaptation of Contraceptive Technology (PIACT) through its Mexican affiliate, PIACT de Mexico, and IFRP are independently and jointly developing low-cost, reusable plastic inserters to be used with many IUD types. Intended especially for postpartum and postabortion insertions, the inserter is longer than the standard model. PIACT reports "encouraging" results in initial tests (47). The long inserter used by International Postpartum Program investigators in Thailand produced a 50 percent reduction in expulsion rates (20), but long inserters have not been distributed or marketed regularly for postpartum use (150, 240). IFRP is also testing insertion by hand, which can be performed immediately postpartum and may reduce perforation and expulsion (150). (See Figure 9.)

Developing and clinical testing of devices with biodegradable retentive components is designed to reduce expulsion following immediate postpartum and postabortion insertion. IFRP is testing modified T and Lippes Loop devices with chromic catgut sutures affixed to the upper arm of the device (see Figure 9). When the device is inserted, the free, clipped ends of the sutures act as tines and hold the device in place during uterine involution. The sutures are dissolved by body fluids and disappear within several weeks after immediate danger of expulsion has passed. In a four-center trial of this system including more than 300 insertions performed immediately after delivery of the placenta in Bangladesh, Cairo, Chile, and Manila, life table expulsion rates of 2.1 at one month and 5.3 at six months have been reported (150). Insertions were performed immediately after delivery yet the expulsion rates so far compare favorably with those for later or non-pregnancy-related insertions. If these results can be confirmed in larger studies, the device would be valuable in developing areas of the world where for many women the only occasion for visiting a clinic or hospital is at delivery.

While hopes remain high that some improvements can be made in IUD performance, especially by the addition of active agents or biodegradable materials, there is probably less expectation now than a decade ago that the device can be improved enough to meet the contraceptive needs of all women. The greatest technical challenge to IUD research and development lies in the fact that the important clinical parameters of IUDs are so interdependent that a design change to increase performance in one area will often result in decreased performance in other areas (137). For example, an increase in the surface area of an IUD can cause a substantial drop in the rate of accidental pregnancy, but at the same time it will probably increase the incidence of removals for bleeding and/or pain. An increase in stiffness will reduce expulsion but also increase the removal rate for bleeding and pain. Thus, while research carried out over the past 20 years has produced a great deal of knowledge about IUDs, it has not produced an ideal IUD that minimizes all clinical problems (360).

A second problem is that those who develop and test new IUDs in small clinical trials often report excellent results, but these results are not duplicated when the device is tested on a wider basis or in national programs. This may be the result of different definitions for events such as removals for bleeding and pain and removals for personal reasons. It may also reflect

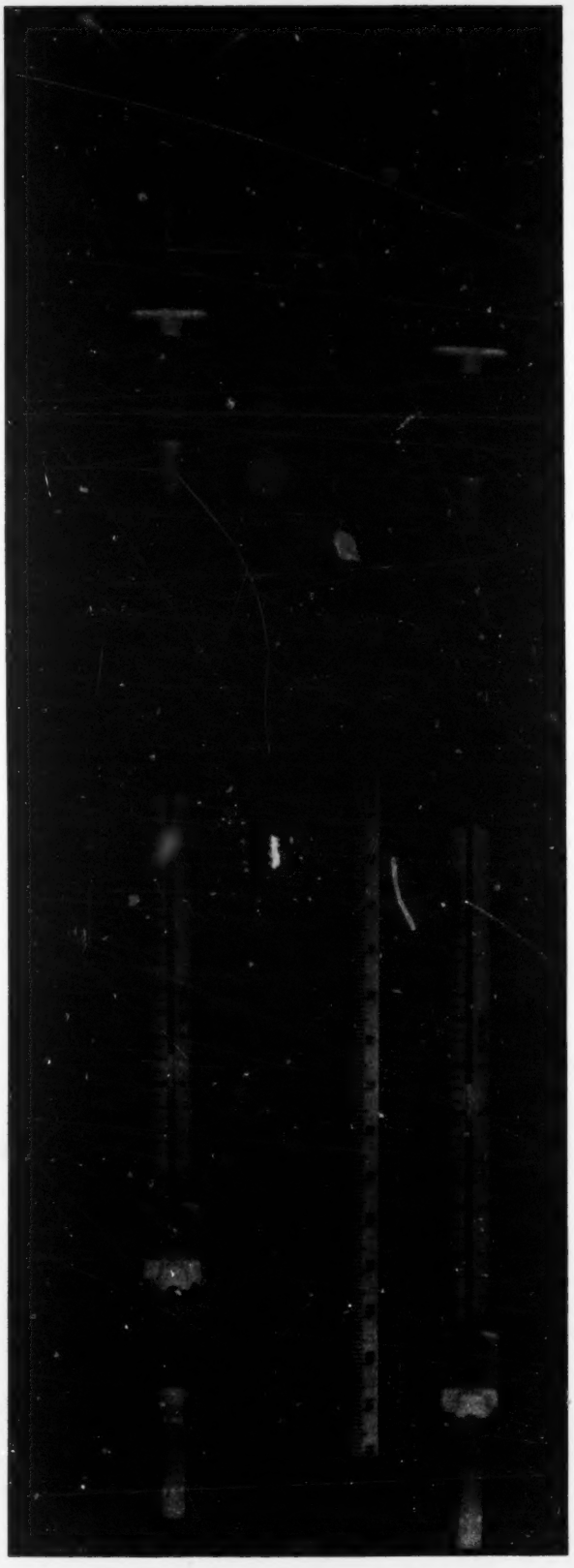


Figure 8. The Uterine Metrology Device, now in its initial experimental stages, permits measurements of uterine cavity depth and cervical canal length (right). By releasing the plastic wings at the tip of the device until they just touch the uterine walls (left), health care personnel can measure the lateral dimension of the uterine cavity as well.

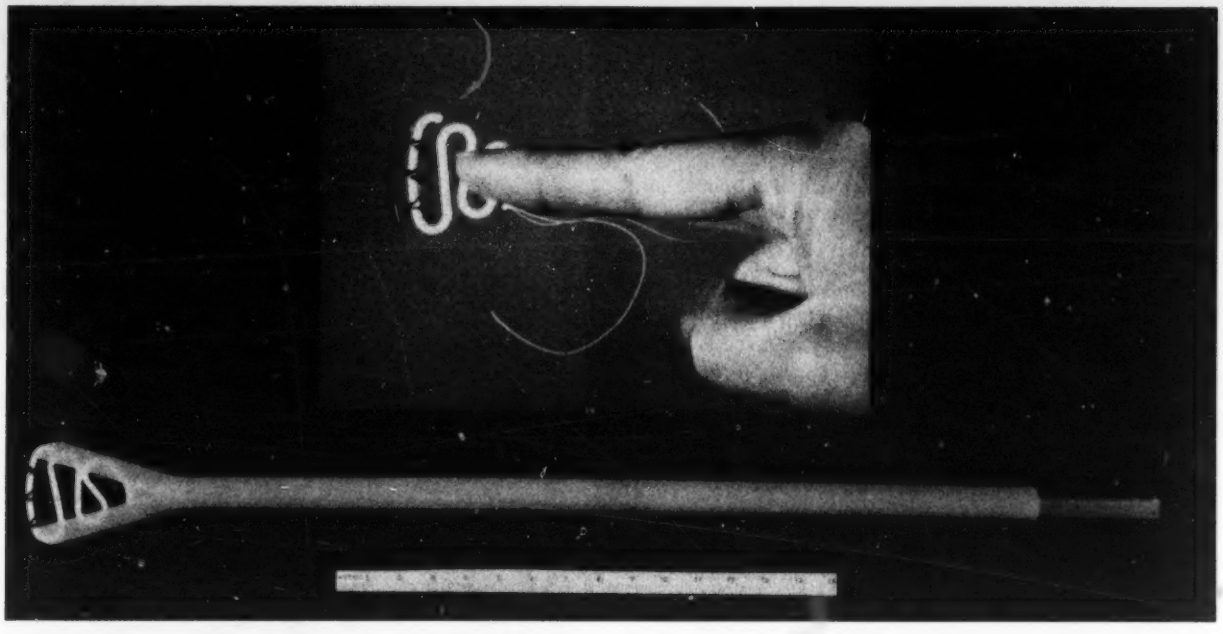


Figure 9. The International Fertility Research Program (IFRP) has modified the Lippes Loop for immediate postpartum insertion by adding projections of biodegradable No. 2 chromic sutures to the upper arm of the device. IFRP is also studying new inserters and hand insertion for early postpartum use.

greater time and individual attention given to users by the developer of a device than by other clinicians. Thus, a number of IUD configurations which showed promise in initial trials proved disappointing when tested in other countries or by other investigators.

A related difficulty in IUD studies is the effect of different program variables. As a result, some centers produce good results with almost any IUD configuration. Even where reporting is uniform and data are directly comparable, the performance of a given IUD varies considerably from one doctor or clinical center to another (26). These discrepancies may arise from differences in the populations evaluated, in the insertion procedures, or in counseling and following-up the women.

Developing and testing IUDs with active ingredients such as copper, zinc, or steroids raises still more research issues. Zipper and colleagues originally argued:

> A rational approach to the evaluation of pharmacologic agents would first include an independent assessment of the effects of the vector [carrier] and the effects of the agent. If on the basis of these tests the pharmacologic agent has the potential for improving IUD performance, then tests to evaluate the combined effects of the carrier and the pharmacologic agent would be conducted. If the effects of the carrier and the agent cannot be

Table 21. Approximate Prices of Selected IUDs for Commercial Sales and Public Sector Programs, 1979

Device	Manufacturer	Commercial Price	Public Sector Price
Lippes Loop D	Ortho USA	$50.54 box of 6	$29.22 box of 6 Overseas contact: local Johnson & Johnson affiliate. Prices depend on local conditions. Price to USAID: $36.00 for packages of 100 with 10 reusable inserters
	Finishing Enterprises Canada		Bulk only. Sliding scale of from $.75 each in boxes of 100 for less than 5,000 to $.08 each for 100,000 or more
Saf-T-Coil	Schmid USA	No bulk packaging; box of 6: $7 per unit	
Multiload	Multilan Switzerland	No bulk packaging; prices determined by local distributors, dependent on local conditions	
Cu-7	Searle USA	Individual packages only: $386.28 box of 30; $1,137.75 box of 100	
TCu-200	Outokumpu Oy Finland	$10-20 per unit	$.35 to $.90, depending on size of order; sterile, individual package
Progestasert	Alza USA	Lots of 6; 6 or 12 units: $18 per unit; 18-47 units: $16 per unit; 48 or more units: $14 per unit	Minimum order 48 units: $8.40 per unit

Source: PIACT (187)

> independently assessed, future research aimed at improving the performance of intrauterine contraceptive devices will necessarily be conducted on a trial and error basis (377).

Yet in fact the most widely used configuration for pharmacologic agents has been the T, which produced an unsatisfactory pregnancy rate of about 18 percent when tested without copper (308). Now trial and error testing must also determine not only the most adaptable plastic base to serve as a carrier, but also the most effective pharmacologic agents for various purposes, the appropriate dosage, form, position, and release rate as well as local and potential systemic side effects.

A further serious problem for the future will be costs. Whereas a simple plastic Lippes Loop can now be manufactured and sold in most countries in bulk at public sector prices ranging from $0.08 to $0.36 (see Table 21), the cost of medicated devices will be much higher. Copper-releasing devices range from $0.35 to $0.90 at the lowest available price for bulk supply. (Commercial prices for both unmedicated and copper devices are about ten times higher.) Progestin-releasing devices are more difficult to manufacture. The lowest public sector prices today are $8.40 and the lowest commercial prices about twice that. Since the manufacture of medicated devices, especially those releasing a controlled measure of progestins, requires expensive, single-purpose equipment, local production will not be efficient for most countries. If the more sophisticated devices are going to be used extensively, a relatively small number of manufacturers will probably produce the world supply.

Finally, making the results of extensive IUD research programs available to health professionals, clinical centers, and national family planning programs will require a high degree of cooperation at the national and international levels. Research networks will need to share protocols and experience; data will have to be fully available and openly discussed; manufacture of devices will have to be arranged at convenient locations providing good quality control and reasonable prices; and finally distribution programs will have to provide adequate supplies and accurate clinical guidance on a large scale. The greatest challenges in IUD development today may be not only technical improvement of devices and clinical procedures but also efficient dissemination of improved devices and equipment to programs that need them.

IUD PHOTOGRAPHS AND INFORMATION

The IUDs in the following photographs are pictured actual size on square centimeter grids. Event rates from multicenter trials of many of these devices are reported in Table 11, p. B-57. Excluded from this section are several devices which were extensively tested but are no longer manufactured — the Majzlin Spring, the M, the Gynekoil, and the Dalkon Shield.

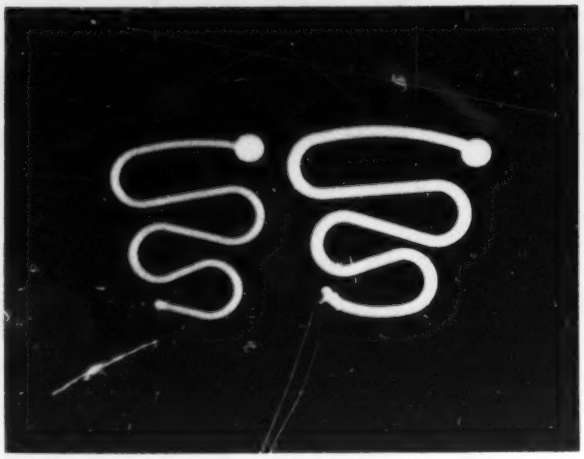


Figure 10. Lippes Loop

Description: One of the first of the modern IUDs and for years the standard, it is probably the most widely used IUD outside of China. Injection molded of alathon-20 polyethylene, it comes in four sizes, the smallest designated A (left), the largest, D (right). Incorporation of barium sulfate in the plastic made the Loop the first radiopaque IUD. With two nylon transcervical threads the Loop was also the first IUD to have a tail.

Developer: Jack Lippes (USA)

Date introduced: 1962

Distributor: Ortho Pharmaceutical Corporation, Raritan, New Jersey 08869, USA

Areas of major use: Worldwide

Inserter type: Push-out

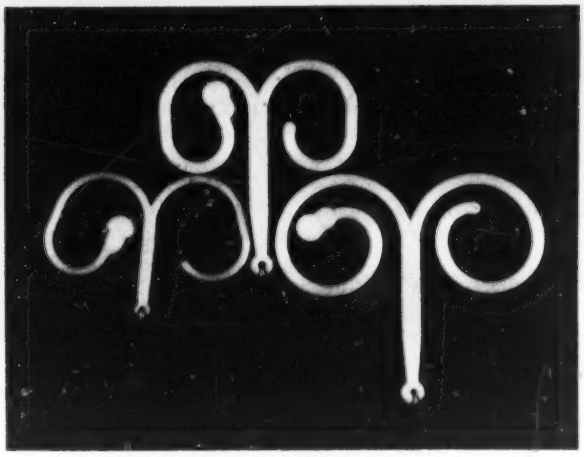


Figure 11. Saf-T-Coil

Description: Injection-molded of ethylene vinyl acetate copolymer with barium sulfate added for radiopacity, the Saf-T-Coil comes in three sizes, the 25-S (left), the 33-S (center), and the 33-S (right). The two transcervical monofilament threads are of nylon.

Developer: Ralph R. Robinson (USA)

Date introduced: 1965

Distributor: Schmid Laboratories, Inc., Little Falls, New Jersey 07424, USA

Areas of major use: Worldwide

Inserter type: Retract over plunger

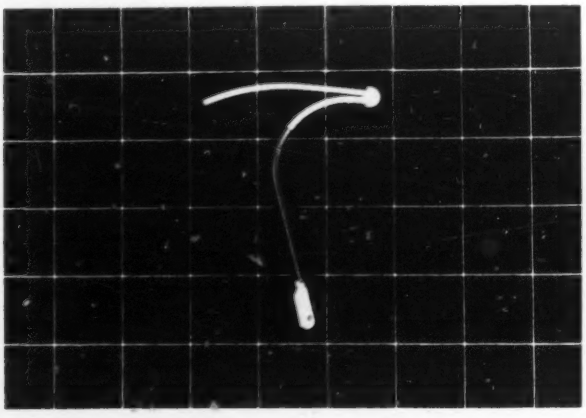


Figure 12. Cu-7, or Gravigard

Description: The Cu-7 obtains its contraceptive effect largely from the 200 sq mm surface area of copper in the form of a wire wrapped around the lower arm of the 7. It is injection-molded of polypropylene homopolymer with barium sulfate added for radiopacity, and it bears a single polypropylene thread. Its diameter is slightly less than the T's (28 mm versus 32 mm).

Developers: Jaime Zipper and Harvey Abramson (Chile)

Date introduced: 1974

Distributor: G. D. Searle & Co., Chicago, Illinois 60680, USA

USFDA-approved effective life: 3 years

Inserter type: Withdrawal

Areas of major use: Australia, Europe, Mexico, USA

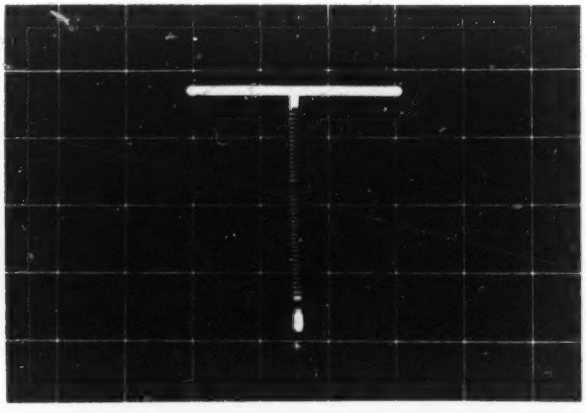


Figure 13. Copper T-200, or Gyne T

Description: Injection molded of polyethylene with barium sulfate added for radiopacity, this device was the first medicated IUD tested for contraceptive use. The fine copper wire wrapped about the vertical stem of the IUD exposes 200 sq mm of copper.

Developers: Howard Tatum (USA) and Jaime Zipper (Chile)

Date introduced: 1972

Distributors: AB Kabi, Stockholm, Sweden; G.D. Searle & Co. Chicago, USA (pending); Outokumpu Oy, Pori, Finland; Ortho Pharmaceutical Ltd., High Wycombe, England; Schering AG, Berlin, Federal Republic of Germany; Leiras, Turku, Finland

USFDA-approved effective life: 3 years

Inserter type: Withdrawal

Areas of major use: Worldwide

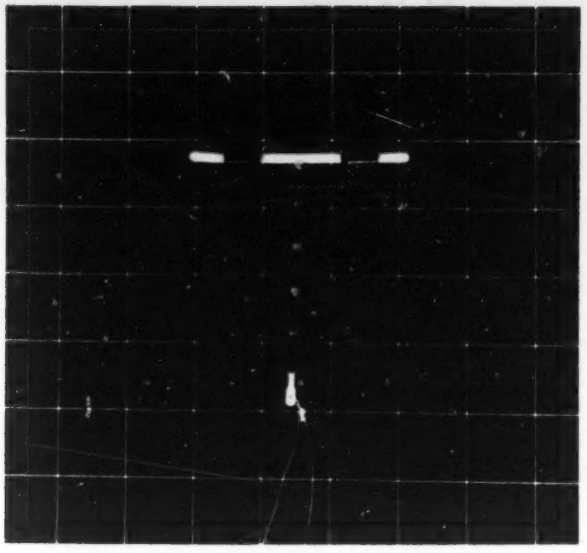


Figure 14. TCu-220

Description: An experimental, modified version of the copper T, the TCu-220 has seven solid copper sleeves, two on the transverse arm and five on the stem. With a total exposed copper surface of 220 sq mm, this device has a longer effective life than the TCu-200.

Developer: Population Council

Developer's estimate of effective life: 20 years

Inserter type: Withdrawal

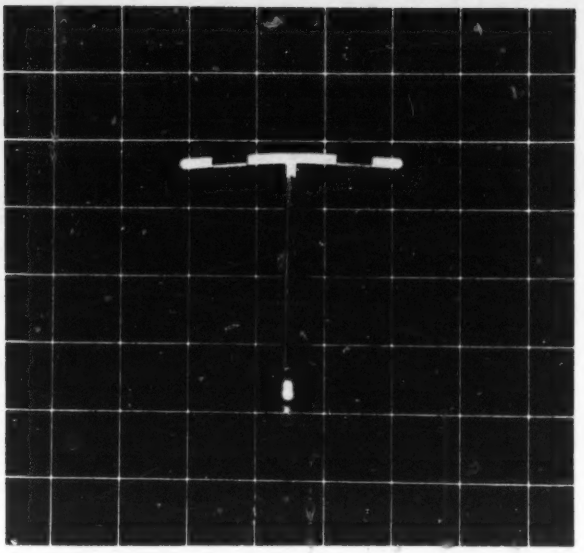


Figure 15. TCu-380 Ag

Description: The TCu-380 Ag carries two sleeves of solid copper on the crossbar and a coil of copper wire, with a core of silver, around the stem. The silver core is intended to keep the copper from fragmenting and so lengthen the effective life of the device. Total exposed copper surface is 380 sq mm. Two monofilament transcervical threads.

Developer: Population Council

Developer's estimate of effective life: 6-10 years

Inserter type: Withdrawal

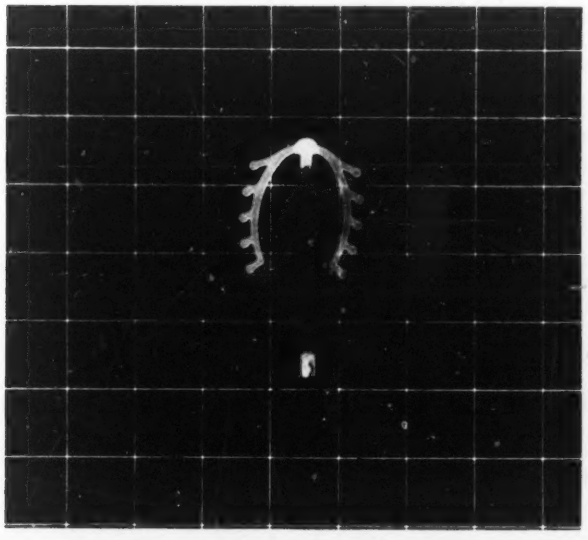


Figure 16. Multiload-cu250, or Multiload-D250

Description: A copper-releasing device with 250 sq mm of exposed copper in the form of wire wrapped around the vertical shaft. The arms are flexible plastic serrated fins that hold the device in place without stretching the uterine cavity. Specially designed inserter does not use a plunger.

Developer: W. A. A. van Os

Date introduced: 1974

Distributors: Multilan S. A., Fribourg, Switzerland; G. D. Searle Ltd. of Canada (pending); Desbergers Ltd., Montreal, Canada (pending)

Manufacturer's recommendation of effective life: 3 years

Inserter type: Withdrawal

Areas of major use: Europe, Canada (pending)

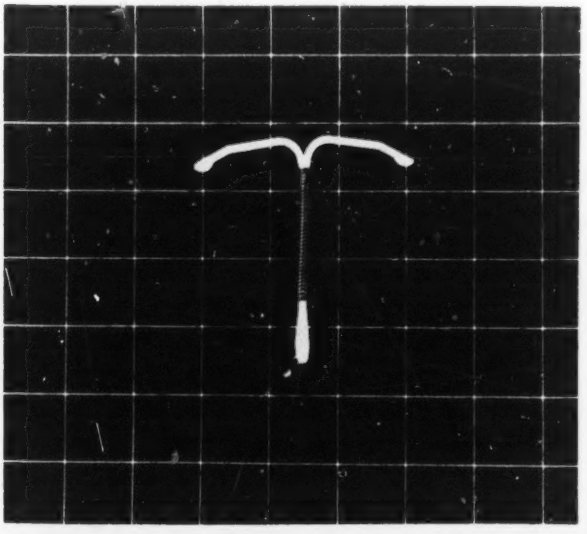


Figure 17. Nova T Cu-200 and 200 Ag

Description: Injection-molded of polyethylene with barium sulfate added for radiopacity. The fine copper wire wrapped about the vertical stem of the device exposes 200 sq mm of copper. A silver core has been added to the wire of the 200 Ag in order to reduce fragmentation.

Developers: Ahti Kosonen and Tapani Luukkainen (Finland)

Date Introduced: 1979

Distributors: Outokumpu Oy, Pori, Finland; Leiras, Turku, Finland: AB Kabi, Stockholm, Sweden; Schering AG, Berlin, Federal Republic of Germany

Manufacturer's recommendation of effective life: 3 years

Inserter type: Withdrawal

Areas of major use: Spain, Austria; pending: Denmark, Norway, Sweden, Switzerland, South Africa, United Kingdom

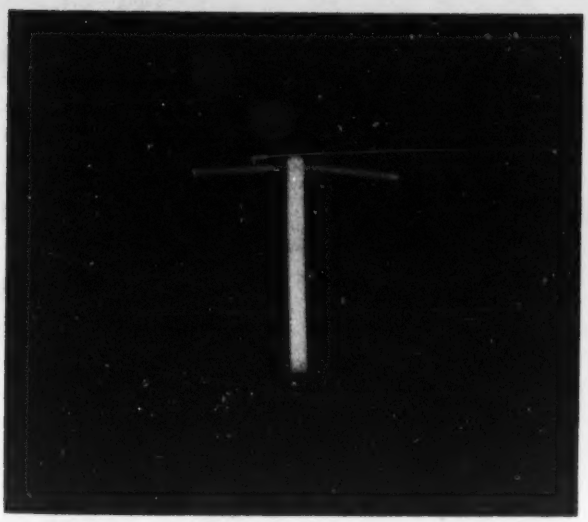


Figure 18. Progestasert Intrauterine (Progesterone) Contraceptive System

Description: Progesterone in silicone oil base is released to the uterus at a rate of 65 μg per day through the wall of the ethylene vinyl acetate copolymer vertical shaft. The reservoir in the shaft contains 38 mg of progesterone. The transverse arm is solid copolymer, and the device has two monofilament transcervical threads.

Developer: Alza Corporation (USA)

Date introduced: 1976

Distributor: Alza Corporation, Palo Alto, California 94304, USA

USFDA-approved effective life: One year

Inserter type: Automatic loading and modified withdrawal

Areas of major use: USA, Federal Republic of Germany, Italy

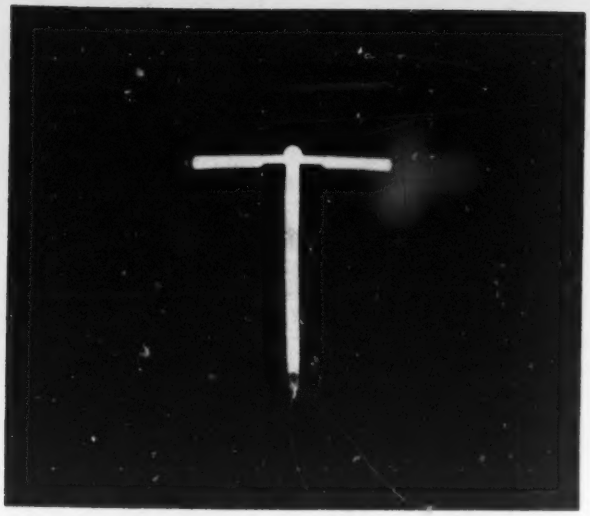


Figure 19. Uterine Therapeutic System

Description: Progesterone or levonorgestrel in polymeric base released into the uterus at a rate of 25 or 2-4 μg per day, respectively, through the wall of the ethylene vinyl acetate copolymer cross arms and vertical shaft. The device has two monofilament transcervical threads. WHO will conduct trials of this device.

Developer: Alza Corporation

Developer's estimate of effective life: 5 years

Inserter type: Automatic loading and modified withdrawal

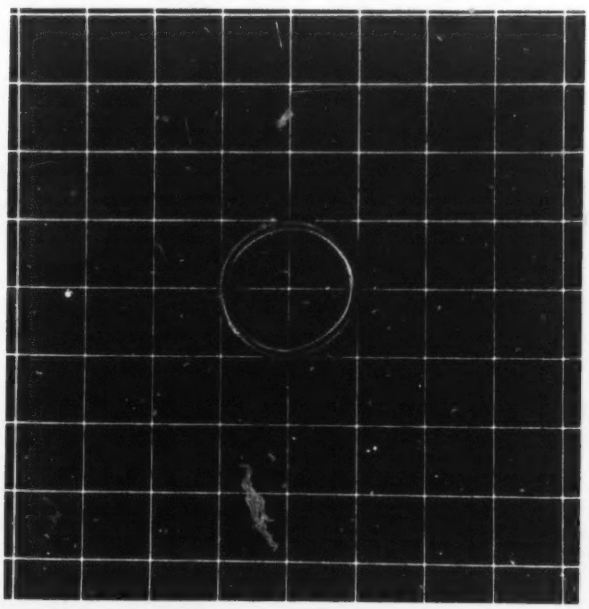


Figure 20. Chinese ring

Description: A ring of coiled stainless steel wire, this IUD is reportedly the first IUD a woman uses in China. The expulsion rate is said to be high; if it is expelled, it is replaced by the Shanghai V, shown in Figure 21. No transcervical threads.

Area of major use: People's Republic of China

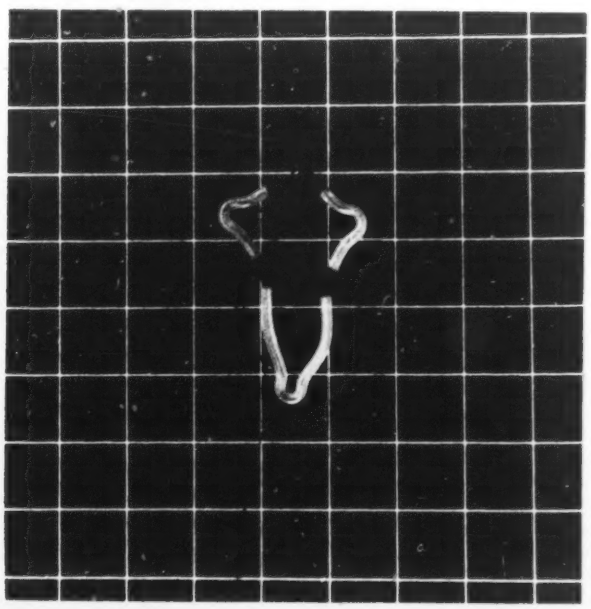


Figure 21. Chinese Shanghai V

Description: Used if the stainless steel ring is expelled, this device is said to remain in place better but to cause more bleeding and pain than the ring. It consists of what appears to be a stainless steel wire covered by a plastic sleeve except in four places where copper wire is wrapped about the stainless steel wire. The device has two monofilament plastic transcervical threads.

Area of major use: People's Republic of China

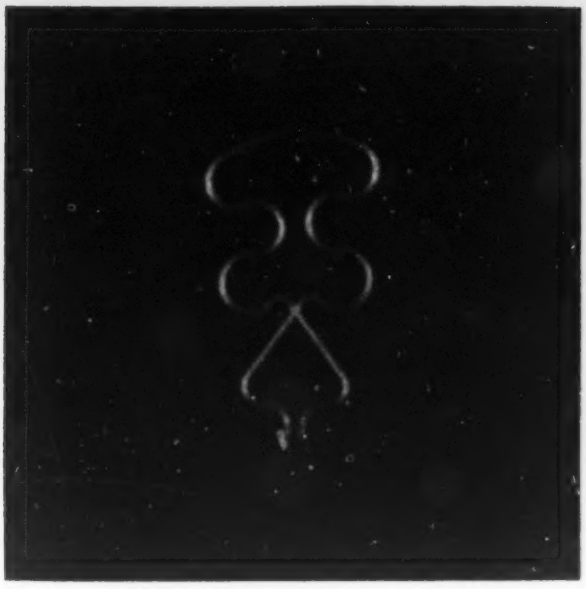


Figure 22. Dana Super

Description: Ethylene vinyl acetate with barium sulfate added for radiopacity. Two nylon cervical threads.

Distributor: State Textile Research Institute, Center for the Application of Radioactive Isotopes in the Textile Industry, Brno-Vaclavska 6, Czechoslovakia

Areas of major use: Eastern Europe, Vietnam

Type of Inserter: Push-out

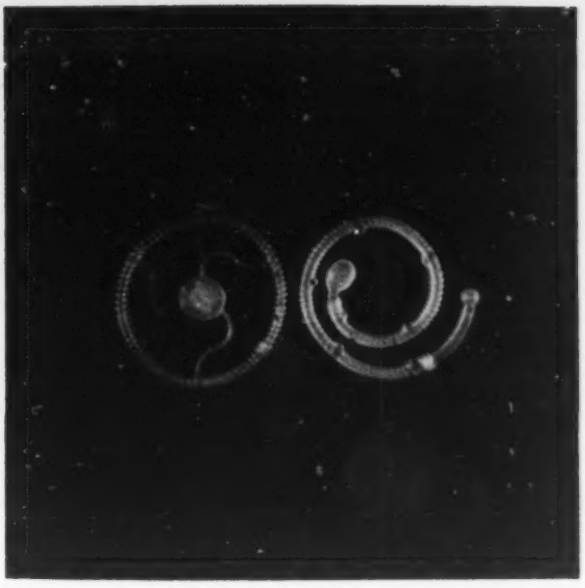


Figure 23. Ohta Ring

Description: A ring of polyethylene, incorporating barium sulfate for radiopacity. Several variants of this design have been produced in Japan, including, recently, a spiral device (right). Reportedly this latest model has not gained popularity, however. No transcervical threads.

Distributor: Ohta Rings, Kenkyu-sho, Tokyo, Japan

Areas of major use: Japan, Taiwan

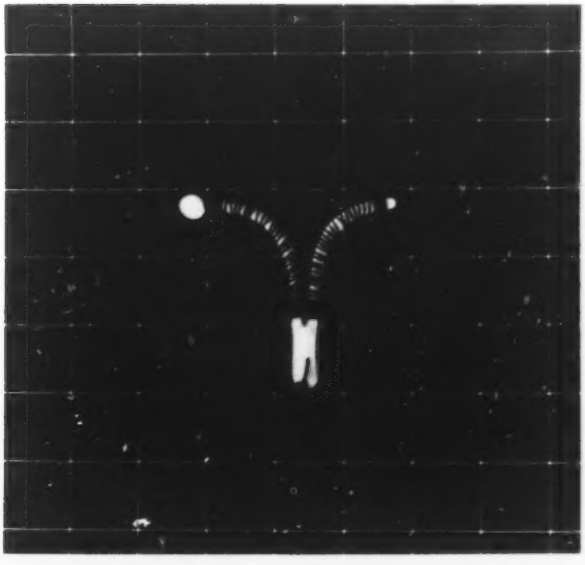


Figure 24. Soonawala Y

Description: A Y-shaped IUD with copper wound around its limbs exposing 250-300 sq mm of surface area. The end of one limb is bulbous to cover the tip of the inserter for ease of insertion.

Developer: R.P. Soonawala (India)

Date introduced: 1972

Developer's recommendation of effective life (preliminary): 4 years

Inserter type: Withdrawal

Area of major use: Bombay, India

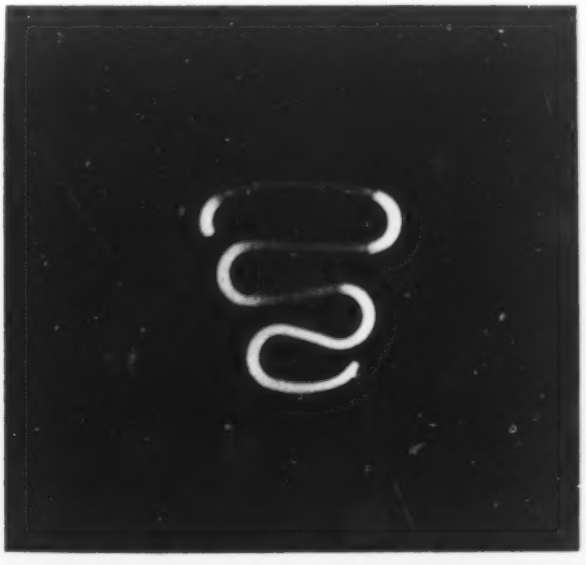


Figure 25. Modified Lippes Loop

Description: The arms of this Lippes Loop D have been coated with ethylene vinyl acetate carrying trasylol, a protease inhibitor, to reduce excessive bleeding. The drug is released at the rate of approximately 100 μg per day.

Developer: International Fertility Research Program

Table 3. Deliveries of IUDs (in Number of Units) Financed by the United States Agency for International Development, by Calendar Year and Area, 1968-1978

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	Total
AFRICA												
Benin	—	—	—	—	—	—	—	1,900	400	—	1,000	3,300
Botswana	—	—	—	3,200	—	—	—	5,000	—	—	—	8,200
Cameroon	—	—	—	—	—	—	—	—	—	—	10,000	10,000
Ethiopia	—	3,000	—	5,000	1,000	4,000	5,000	4,300	—	—	—	22,300
Gambia	—	—	—	1,300	1,000	1,000	1,300	4,750	—	—	—	9,350
Ghana	5,000	30,000	23,000	65,500	18,000	35,600	10,000	3,000	—	—	40,000	230,100
Kenya	1,000	50,000	30,000	—	30,000	22,000	13,000	7,750	12,100	—	—	165,850
Lesotho	—	—	—	—	—	2,200	100	800	—	—	—	3,100
Liberia	—	2,000	2,000	6,000	7,000	1,700	3,000	160,000	—	—	—	181,700
Morocco	—	—	—	—	30,000	—	56,000	1,000	—	29,000	—	116,000
Nigeria	—	35,000	—	6,300	35,000	30,100	23,000	11,000	—	—	—	140,400
Sierra Leone	400	—	4,000	1,000	5,000	6,000	2,000	8,500	2,000	—	—	28,900
Senegal	—	—	4,000	3,000	—	—	—	—	—	—	—	7,000
South Africa	—	—	—	—	—	5,000	—	—	—	—	—	5,000
Sudan	—	—	—	—	3,000	1,000	—	600	—	—	—	4,600
Tanzania	—	—	—	3,000	3,000	32,000	35,000	—	—	—	5,000	78,000
Tunisia	—	—	—	—	2,500	27,120	27,000	—	—	—	—	56,620
Uganda	—	—	2,000	2,760	5,000	4,000	10,000	—	—	—	—	23,760
Zaire	—	—	—	—	—	7,880	—	8,000	—	24,000	—	39,880
Zambia	—	—	—	—	—	2,600	—	2,250	2,000	—	—	6,850
Subtotal	6,400	120,000	65,000	97,060	140,500	182,200	185,400	218,850	16,500	53,000	56,000	1,140,910
ASIA												
Afghanistan	—	10,000	10,000	—	—	5,000	—	—	—	4,000	—	29,000
Bangladesh	—	—	—	—	800	—	201,000	—	200,000	—	—	401,800
Egypt	—	—	—	—	—	—	1,000	50,000	130,000	—	—	181,000
Fiji	—	—	5,000	—	—	—	1,000	—	—	—	—	6,000
Hong Kong	—	—	—	19,904	10,000	—	13,000	6,000	—	—	—	48,904
Indonesia	10,000	—	—	—	100,000	20,000	97,000	—	—	—	220,000	447,000
Iran	—	—	—	—	—	500	2,000	100	700	—	—	3,300
Iraq	—	—	—	—	—	3,500	8,000	5,000	500	—	—	17,000
Israel	—	—	—	—	—	—	1,000	2,000	—	—	—	3,000
Jordan	—	—	—	—	—	5,000	—	2,000	—	—	—	7,000
Laos	—	—	5,000	10,000	12,000	5,500	10,000	—	—	—	—	42,500
Lebanon	—	—	—	35,000	—	—	2,000	2,500	—	—	—	39,500
Malaysia	—	—	1,000	21,000	5,600	2,000	12,000	1,900	—	—	—	43,500
Nepal	1,000	—	—	—	10,000	—	1,500	—	8,000	—	9,000	29,500
Pakistan	—	—	—	—	4,000	2,500	5,000	10,000	—	—	—	21,500
Philippines	—	35,000	90,000	100,000	95,500	293,456	25,000	96,000	—	—	—	734,956
Ryukyu Islands	—	—	—	—	4,800	—	—	—	—	—	—	4,800
Singapore	800	16,300	—	—	—	—	—	—	—	—	—	17,100
Sri Lanka	5,000	10,000	—	—	1,000	7,000	8,000	—	—	—	—	31,000
Syria	—	—	—	—	—	—	—	—	8,000	—	—	8,000
Thailand	—	—	—	—	—	—	—	1,000	—	—	—	1,000
Turkey	—	—	—	—	—	—	—	—	43,000	—	—	43,000
Vietnam	—	—	—	—	—	—	60,100	—	—	—	—	60,100
Subtotal	16,800	71,300	111,000	185,904	243,700	344,456	447,600	176,500	390,200	4,000	229,000	2,220,460
WESTERN HEMISPHERE												
Argentina	8,000	—	20,000	12,000	11,000	21,000	—	—	—	—	—	72,000
Bolivia	2,000	—	—	—	—	—	—	—	—	—	—	2,000
Colombia	5,000	—	40,000	80,000	100,000	100,000	45,000	70,000	—	—	—	440,000
Chile	—	5,000	80,500	15,000	23,000	30,000	30,000	21,000	—	50,000	—	254,500
Costa Rica	10,500	—	25,000	—	10,000	17,000	9,000	2,000	—	—	—	73,500
Curacao	—	3,000	—	200	—	—	—	1,200	300	—	—	4,700
Dominican Rep.	4,000	2,000	—	—	16,000	—	—	—	—	—	—	22,000
Ecuador	15,000	5,000	20,000	22,000	6,000	—	—	40,000	—	—	—	108,000
El Salvador	12,000	—	—	—	2,500	23,040	26,000	—	1,200	—	5,002	69,742
Guatemala	10,000	7,500	10,000	30,000	3,000	—	9,000	—	—	—	—	69,500
Honduras	1,000	—	—	20,000	5,000	5,000	3,000	2,500	—	—	—	36,500
Jamaica	1,000	—	1,000	1,000	—	22,000	—	2,000	2,400	13,200	—	42,600
Leeward Islands	2,000	—	—	200	1,300	1,100	700	2,800	—	—	—	8,100
Mexico	3,000	—	—	—	—	—	—	—	—	—	—	3,000
Nicaragua	—	—	—	—	—	50,000	50,000	10,000	1,600	—	—	111,600
Panama	5,000	—	6,000	6,500	35,400	—	—	—	25,000	—	—	77,900

Table 3 (Continued)

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	Total
Paraguay	5,000	—	6,500	19,500	22,500	36,500	25,000	24,000	600	—	—	139,600
Peru	—	—	10,000	10,000	5,000	25,000	—	—	—	—	—	50,000
Surinam	—	1,000	—	—	—	500	3,000	1,000	—	—	—	5,500
Trinidad	—	2,000	—	—	—	—	5,000	—	—	—	—	7,000
Uruguay	1,000	—	15,000	—	2,000	—	—	5,800	—	—	500	24,300
Venezuela	5,500	5,000	60,000	7,500	77,000	126,000	78,000	38,000	—	—	—	397,000
Windward Islands	7,000	—	3,000	—	1,900	4,000	900	600	—	—	—	17,400
Subtotal	97,000	30,500	297,000	223,900	321,600	461,140	284,600	220,900	31,100	63,200	5,502	2,036,442
Country NA	47,500	17,500	397,500	530,000	461,000	425,200	439,700	209,000	250,500	589,500	342,000	3,798,400
TOTAL	167,700	239,300	870,500	1,036,864	1,166,800	1,412,996	1,357,300	914,250	688,300	709,700	632,502	9,196,212

Source: USAID, Office of Population (331)

Table 4. Purchases of Intrauterine Devices by United Nations Children's Fund Financed by the United Nations Fund for Population Activities, by Calendar Year, 1974-1978

	1974	1975	1976	1977	1978
AFRICA					
Algeria		4,080*	1,000		24,195
Cape Verde Isl.					8,000
Egypt					125,000
Mali				3,900	56,820
Mauritius		300*			
Nigeria			11,000	3,500	
Swaziland			5,000	500	1,000
Tunisia	5,000	70,000*	90,000	160,000	
Turkey			25,000		
Subtotal	5,000	74,380	132,000	167,900	215,015
ASIA					
Bangladesh					1,000
Fiji				2,400	
India		1,000,000			
Jordan				5,500	
Malaysia		1,600			
Pakistan					105,000
Pacific Isl.					2,600
Singapore	300	850	500		
Thailand				40,000	300,000
Tonga		1,600*			
Vietnam					551,020
Subtotal	300	1,004,050	500	47,900	959,620
WESTERN HEMISPHERE					
Chile		102,100	591,000		
Cuba		190,000		69,000	381,000
Jamaica					
Mexico		61,000*			
Paraguay			4,000		
Venezuela					220,000
Subtotal		353,100	595,000	67,000	601,000
TOTAL	5,300	1,431,530	727,500	282,800	1,775,635

*Including TCu-200s drawn from stockpile

Source: Badham, UNFPA (19)

Table 5. Purchases of Intrauterine Devices by World Health Organization Financed by the United Nations Fund for Population Activities, by Calendar Year, 1976-1978

	1976	1977	1978
AFRICA			
Lesotho			500
Sudan	9,000		11,710
Togo			25,000
Subtotal	9,000		37,210
ASIA			
Cook Islands	1,600	600	600
Jordan			6,000
Mongolia			1,350
Papua-New Guinea	12,300		
Solomon Islands	3,000		
Syria	5,000		3,000
Tonga	500	500	500
Western Samoa			100
Yemen, People's Democratic Republic	28,000		1,000
Yemen, Arab Republic	3,150		
Subtotal	53,550	1,100	12,500
TOTAL	62,550	1,100	49,760

Source: Badham, UNFPA (19)

Table 6. Deliveries of IUDs Financed by the Swedish International Development Authority, by Type and Area, 1967-1978
(Number of Units)

	Lippes Loop	Saf-T-Coil	Dana Super	Copper T	Cu-7	Other
AFRICA						
Algeria	1,000 (1969)	900 (1969) 600 (1972)				
Ethiopia				500 (1972)		
Kenya	50,000 (1970) 13,000 (1975) 37,000 (1976) 150,000 (1977)			1,000 (1976)		
Subtotal	251,000	1,500		1,500		
ASIA						
Malaysia						7,500 (1974)
Sri Lanka	10,100 (1967) 140,000 (1973) 120,000 (1975) 290,000 (1976) 350,000 (1977)			1,000 (1975) 25,000 (1978)		
Thailand		10,000 (1971)				
Vietnam	5,000 (1973) 10,500 (1976)	400 (1974)	10,000 (1971) 100,000 (1972) 100,000 (1973) 300,000 (1974) 450,000 (1975) 650,000 (1976) 1,390,000 (1977)	450 (1974) 5,000 (1976) 5,000 (1977)	1,000 (1976) 1,000 (1977)	860 (1974)
Subtotal	925,600	10,400	3,000,000	36,450	2,000	8,360
WESTERN HEMISPHERE						
Cuba	29,000 (1975) 600,000 (1977)	50,000 (1972)				
Subtotal	629,000	50,000				
TOTAL	1,805,600	61,900	3,000,000	37,950	2,000	8,360

Source: Swedish International Development Authority (304)

Table 9. New Acceptors of IUDs in 22 Countries with National Family Planning Programs, 1968-77

Country and Year	Total Acceptors (Thousands)	Acceptors of IUDs (Thousands)	Acceptors of IUDs as Percent of Total Acceptors
AFRICA			
Egypt			
1968	134.0	47.0	35.0
1970	206.0	57.0	27.6
1972	237.0	85.0	35.8
1974	143.0	66.0	46.1
1976	187.0	84.0	44.9
1977	—	95.0	—
Ghana			
1972	30.5	3.2	10.4
1974	34.2	2.8	8.1
1976	32.0	2.8	8.7
1977	33.5	2.7	8.0
Kenya			
1968	8.8	3.7	42.0
1970	30.9	18.1	58.5
1972	43.0	4.7	10.9
1974	49.2	4.6	9.3
1976	61.2	7.1	11.6
1977	71.4	10.1	14.1
Morocco			
1968	8.5	7.5	88.2
1970	22.8	9.8	42.9
1972	27.5	6.3	22.9
1974	55.4	6.3	11.4
1976	78.0	6.2	8.0
Tunisia			
1974	50.9	19.1	37.5
1976	73.5	20.8	28.2
ASIA			
Afghanistan			
1974	11.0	1.1	10.0
1976	16.6	1.2	7.2
Bangladesh			
1972	142.5	8.5	5.9
1974	187.8	31.9	16.9
1976	1,103.1	77.9	7.0
1977	903.8	44.5	4.9

Table 9 (Continued)

Country and Year	Total Acceptors (Thousands)	Acceptors of IUDs (Thousands)	Acceptors of IUDs as Percent of Total Acceptors
India[1]			
1968	3,115.0	479.0	15.3
1970	3,782.0	476.0	12.5
1972	5,899.0	355.0	6.0
1974	4,406.0	443.0	10.0
1976	12,806.0	580.0	4.5
1977	4,714.0	317.0	6.8
Indonesia[1]			
1968	25.1	13.8	54.9
1970	181.1	76.4	42.1
1972	1,079.0	380.0	35.2
1974	1,593.0	187.0	11.7
1976	2,213.0	400.0	18.0
1977	2,246.0	366.0	16.3
Iran			
1972	445.0	19.0	4.2
1974	481.0	19.4	4.0
1976	572.0	25.4	4.4
1977	621.0	16.7	2.7
Malaysia, Peninsular			
1968	70.4	1.2	1.7
1970	56.0	0.8	1.4
1972	56.4	1.1	1.9
1974	61.7	0.8	1.2
1976	75.2	1.1	1.4
1977	80.4	1.1	1.1
Nepal			
1972	50.6	1.2	2.3
1974	104.4	1.1	1.0
1976	138.8	1.6	1.1
Pakistan			
1972	—	136.1	—
1974	—	112.5	—
1975	2,086.0	189.0	9.0
Philippines			
1972	622.0	83.0	13.3
1974	747.0	77.1	10.3
1976	647.0	43.3	6.7
1977	509.0	41.5	8.1
Taiwan[2]			
1968	122.9	101.4	82.5
1970	160.2	97.4	60.7
1972	272.0	152.0	55.8
1974	284.0	157.0	55.2
1976	325.0	181.0	55.6
1977	338.0	177.0	52.4
Thailand[3]			
1968	51.6	35.3	68.4
1970	202.9	74.4	36.6
1972	384.0	90.1	23.4
1974	404.0	73.6	18.2
1976	533.0	59.0	11.1
1977	644.0	61.3	9.5
WESTERN HEMISPHERE			
Colombia[4]			
1968	49.6	32.3	65.1
1970	125.0	73.0	58.4
1972	80.4	—	—
1974	171.8	63.6	37.0
1976	156.7	55.9	35.7
1977	142.1	52.7	37.1
Costa Rica			
1968	10.0	2.8	28.0
1970	12.7	1.8	14.1
1972	26.7	2.4	8.9
1974	25.7	1.9	7.3
1976	28.8	1.6	5.5
1977	22.6	0.4	1.8
Dominican Republic			
1968	3.6	1.4	38.8
1970	17.2	7.0	40.6
1972	18.7	5.7	30.4
1974	38.1	6.4	16.7
1976	61.5	6.0	9.7
1977	88.9	5.9	6.6
Ecuador			
1968	3.1	1.5	48.3
1970	5.5	2.6	47.2
1972	17.4	8.3	47.7
1974	35.2	14.4	40.9
1976	32.3	11.3	34.9
El Salvador			
1972	36.8	—	—
1974	41.3	7.6	18.4
1976	56.0	8.2	14.6
1977	51.3	7.4	14.4
Mexico[5]			
1968	10.7	4.2	39.2
1970	25.1	8.5	33.8
1972	45.0	14.0	31.1
1974	541.0	285.0	52.6
1975	608.0	297.0	48.8
1977	845.7	—	—

[1]India, Indonesia — data for 1968, 1970 include postpartum program acceptors; data are for fiscal year beginning April 1 of indicated year.

[2]Taiwan — data for 1972-1976; approximately one-third represent acceptors of reinsertion.

[3]Thailand — data for 1968, 1970 include postpartum program acceptors; annual totals exclude an estimated 16 percent duplication of acceptors by method. The increase in 1974 over 1972 acceptors results largely from the inclusion of acceptors in selected private sector service centers that have joined the government's reporting system.

[4]Columbia — data for 1968, 1970 include postpartum program acceptors; subsequent years data represent latest estimate.

[5]Mexico — data for 1968, 1970 include postpartum program acceptors and acceptors in private clinics now part of national program; data for 1974 relate to acceptors of contraceptives in the governmental facilities as well as in the Foundation for Population Studies (FEPAC), an IPPF affiliate. For all other years, data relate to FEPAC only. For 1977 FEPAC contraceptive acceptors totaled 49,900; of that total, 8,300 accepted IUDs.

Source: Nortman & Hofstatter (203, 204)

BIBLIOGRAPHY

1. ANONYMOUS. Contraception in Europe. IPPF Europe Regional Information Bulletin 8(1): 1-2. January 1979.

2. ANONYMOUS. Doctors and devices. People 5(1): 37. 1978.

3. ANONYMOUS. Indonesia village programs stress pill continuation while medical clinics start women on method use. International Family Planning Digest 2(3): 3-5. September 1976.

4. ANONYMOUS. Intrauterine devices will carry PID risk warning. Ob. Gyn. News 13(17): 2. September 1, 1978.

5. ANONYMOUS. IUDs and heavy periods. [Editorial] British Medical Journal 1(6005): 304. February 7, 1976.

6. ANONYMOUS. Less menstrual blood loss with Progestasert. Ob. Gyn. News 12(4): 13. February 15, 1977.

7. ANONYMOUS. The nulliparous patient, the IUD, and subsequent fertility. British Medical Journal 2(6132): 233. July 22, 1978.

8. ANONYMOUS. The pill and the poor. People 5(1): 36. 1978.

9. ANONYMOUS. Salpingitis, sometimes iatrogenic, called serious threat to fertility. Ob. Gyn. News 12(18): 1, 17. September 15, 1977.

10. ADLI, A.G. and BEROUKHIM, F. A study on the long-term effect of intrauterine contraceptive device. Wisconsin Medical Journal 73: 561-562. May 1974.

11. AKINLA, O., LUUKKAINEN, T., and TIMONEN, H. Important factors in the use-effectiveness of the copper-T-200 IUD. Contraception 12(6): 697-707. December 1975.

12. ALVIOR, G.T., Jr. Pregnancy outcome with removal of intrauterine device. Obstetrics and Gynecology 41(6): 894-896. June 1973.

13. ALZA PHARMACEUTICALS. The Progestasert: intrauterine progesterone contraceptive system: release rated 65µg/day progesterone for one year: a new contraceptive. Palo Alto, California, Alza Corporation, May 1976. 42 p.

14. AMERICAN COLLEGE OF OBSTETRICIANS AND GYNECOLOGISTS. The intrauterine device. ACOG Technical Bulletin, No. 40, June 1976. 4 p.

15. ANDERSON, A.B.M., HAYNES, P.J., GUILLEBAUD, J., and TURNBULL, A.C. Reduction of menstrual blood-loss by prostaglandin-synthetase inhibitors. Lancet 1(7963): 774-776. April 10, 1976.

16. ANDOLŠEK, L. Experience with immediate post-abortion insertions of the IUD. In: Lewit, S., ed. Abortion techniques and services. (Proceedings of the Conference, New York, June 3-5, 1971) Amsterdam, Excerpta Medica, 1972. (International Congress Series 255) p. 63-67.

17. ÅSTEDT, B. and LIEDHOLM, P. IUDs and fibrinolysis. [Letter] British Medical Journal 1(6016): 1017. April 24, 1976.

18. AZNAR, R., BERRY, C.L., COOKE, I.D., CUADROS, A., GRAY, R., McNICOL, G.P., NEWTON, J.R., PIZARRO, E., ROWE, P.J., SHAW, S.T., Jr., WAGATSUMA, T., WEBB, F., and WILSON, E. Ectopic pregnancy rates in IUD users. [Letter] British Medical Journal 1(6115): 785-786. March 25, 1978.

19. BADHAM, D.R. [UN Fund for Population Activities] [IUD purchases] Personal communication, March 23, 1979. 8 p.

20. BANHARNSUPAWAT, L. and ROSENFIELD, A.G. Immediate postpartum IUD insertion. Obstetrics and Gynecology 38(2): 276-285. August 1971.

21. BARRON, B.A., WEINSTEIN, H., and RICHART, R.M. An investigation of the effects of the intrauterine contraceptive device based on a longitudinal study of a self-selected sample of Barbadian women. American Journal of Obstetrics and Gynecology 124(7): 723-729. April 1, 1976.

22. BATÁR, I. and THOMAS, M.N. One year's experience with the Ypsilon-Y IUD. International Journal of Obstetrics and Gynaecology 16(4): 333-338. January-February 1979.

23. BERAL, V. An epidemiological study of recent trends in ectopic pregnancy. British Journal of Obstetrics and Gynaecology 82: 775-782. October 1975.

24. BERGSJØ, P., LANGENGEN, H., and AAS, J. Tubal pregnancies in women using progestagen-only contraception. Acta Obstetricia et Gynecologica Scandinavica 53(4): 377-378. 1974.

25. BERNARD, R.P. Factors governing IUD performance. American Journal of Public Health 61(3): 559-567. March 1971.

26. BERNARD, R.P. I.U.D. performance patterns: a 1970 world view. International Journal of Gynaecology and Obstetrics 8(6, Pt. 2): 926-940. November 1970.

27. BONNAR, J. Progestagen-only contraception and tubal pregnancies. [Letter] British Medical Journal 1(5902): 287. February 16, 1974.

28. BONNEY, W.A., Jr., GLASSER, S.R., CLEWE, T.H., NOYES, R.W., and COOPER, C.L. Endometrial response to the intrauterine device. American Journal of Obstetrics and Gynecology 96(1): 101-113. September 1, 1966.

29. BRENNER, P.F. and MISHELL, D.R., Jr. Progesterone and estradiol patterns in women using an intrauterine contraceptive device. Obstetrics and Gynecology 46(4): 456-459. October 1975.

30. BURNHILL, M.S. Prescriptive approaches to IUD usage. In: Wheeler, R.G., Duncan, G.W., and Speidel, J.J., eds. Intrauterine devices: development, evaluation, and program implementation. [Proceedings of a Workshop on Advances in IUDs, Battelle Seattle Re...arch Center, Seattle, Washington, October 18-20, 1973] New York, Academic Press, 1974. p. 79-89.

31. CALLENDAR, S.T., WARNER, G.T., and COPE, E. Treatment of menorrhagia with tranexamic acid: a double-blind trial. British Medical Journal 4(5729): 214-216. October 24, 1970.

32. CAMP, S.L. Journal notes from the second visit of family planning professionals to the People's Republic of China, November 1-22, 1978. 30 p. (Unpublished)

33. CATES, W., Jr., ORY, H.W., ROCHAT, R.W., and TYLER, C.W., Jr. The intrauterine device and deaths from spontaneous abortion. New England Journal of Medicine 295(21): 1155-1159. November 18, 1976.

34. CERDINO, A. Family planning courses for nurses and midwives in the Philippines. IPPF Medical Bulletin 12(5): October 1978. p. 1.

35. CHAUDHURI, G. Influence of indomethacin, an inhibitor of prostaglandin synthesis, on IUD-mediated increase in motility and hypertrophy of the rat uterine horn. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 477-480.

36. CHOW, A.W., MALKASIAN, K.L., MARSHALL, J.R., and GUZE, L.B. The bacteriology of acute pelvic inflammatory disease: value of cul-de-sac cultures and relative importance of gonococci and other aerobic or anaerobic bacteria. American Journal of Obstetrics and Gynecology 122(7): 876-879. August 1, 1975.

37. CHRISTIAN, C.D. The intrauterine device. Journal of Reproductive Medicine 21(5, Suppl.): 252-253. November 1978.

38. CHRISTIAN, C.D. Maternal deaths associated with an intrauterine device. American Journal of Obstetrics and Gynecology 119(4): 441-444. June 15, 1974.

39. CHRISTIAN, C.D. The morbidity and mortality of mid-trimester sepsis associated with IUDs. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 429-430.

40. COMBINED BANGKOK HOSPITAL GROUP and WRIGHT, N.H. Unsuspected pelvic infection discovered at tubal ligation: relationship to use of intrauterine contraception. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 401-409.

41. CORSA, L. Seeing the flowers from a flying horse: personal report of a trip to China, 30 October-21 November 1978. (Unpublished)

42. CUCA, R. and PIERCE, C.S. Korea. In: Cuca, R. and Pierce, C.S. Experiments in family planning: lessons from the developing world. Baltimore, Maryland, Johns Hopkins University Press, 1977. p. 164-183.

43. CURLIN, P., KHAN, M., and CHOUDHURY, S. Household distribution of contraceptives in Bangladesh: the urban experience. In: Gardner, J.S., Mertaugh, M.T., Micklin, M., and Duncan, G.W., eds. Village and household availability of contraceptives: Africa/West Asia. Seattle, Washington, Battelle Memorial Institute, Human Affairs Research Centers, [1977]. p. 231-250.

44. DAVIS, H.J. Intrauterine devices of contraception: the IUD. Baltimore, Maryland, Williams and Wilkins, 1971. 210 p.

45. DAVIS, H.J. and LESINSKI, H. Uterine variables in IUD design. In: Wheeler, R.G., Duncan, G.W., and Speidel, J.J., eds. Intrauterine devices: development, evaluation, and program implementation. [Proceedings of a Workshop on Advances in IUDs, Battelle Seattle Research Center, Seattle, Washington, October 18-20, 1973] New York, Academic Press, 1974. p. 91-97.

46. DREISHPOON, I.H. Complications of pregnancy with an intrauterine contraceptive device in situ. American Journal of Obstetrics and Gynecology 121(3): 412-413. February 1, 1975.

47. DUNCAN, G. [Program for the Introduction and Adaptation of Contraceptive Technology] [Research on IUDs] Personal communication, March 2, 1979. 1 p.

48. DUNCAN, G.W. and KALKWARF, D.R. Sustained release systems for fertility control. In: Hafez, E.S.E. and Evans, T.N., eds. Human reproduction: conception and contraception. Hagerstown, Maryland, Harper and Row, 1973. p. 483-504.

49. EASTMAN, N.J. and HELLMAN, L.M. Ectopic pregnancy. In: Eastman, N.J. and Hellman, L.M. Williams' obstetrics. 13th ed. New York, Appleton-Century-Crofts, 1966. p. 541-569.

50. ECHEVERRY, G. Family planning in the immediate postpartum period. Studies in Family Planning: 4(2): 33-35. February 1973.

51. EDELMAN, D.A., BERGER, G.S., and KEITH, L. Intrauterine devices and their complications. Boston, Massachusetts, G.K. Hall. (In press)

52. EINHORN, R.F. and TRIAS, M. Differences between physicians and nurses in providing family planning services: findings from a Bogota clinic. Studies in Family Planning 9(2-3): 35-38. February-March 1978.

53. ELKINS, H. [Columbia University, Center for Population and Family Health] [Research on IUDs] Personal communication, March 2, 1979.

54. ERICKSSON, R. and PHARRISS, B.B. Aspects of Progestasert system use not reported in life tables. In: Mishell, D.R., Jr. and Martinez-Manautou, J., eds. Proceedings of a Symposium on Clinical Experience with the Progesterone Uterine Therapeutic System, Acapulco, Mexico, October 15-16, 1976. Princeton, New Jersey, Excerpta Medica, 1978. p. 123-128.

55. ERKKOLA, R. and LIUKKO, P. Intrauterine device and ectopic pregnancy. Contraception 16(6): 569-574. December 1977.

56. ESCHENBACH, D.A., HARNISCH, J.P., and HOLMES, K.K. Pathogenesis of acute pelvic inflammatory disease: role of contraception and other risk factors. American Journal of Obstetrics and Gynecology 126(8): 838-850. August 15, 1977.

57. FAMILY PLANNING RESEARCH UNIT. An enquiry into ectopic pregnancy and the intrauterine device. Devon, England, University of Exeter, Family Planning Research Unit, May 1974. 14 p.

58. FATHALLA, M.F. Research needs in population and family planning: a view from the developing world. Draper Fund Report, No. 6, Summer 1978. p. 6-8.

59. FAULKNER, W.L. and ORY, H.W. Intrauterine devices and acute pelvic inflammatory disease. Journal of the American Medical Association 235(17): 1851-1853. April 26, 1976.

60. FINCH, B.E. and GREEN, H. Contraception through the ages. Springfield, Illinois, Charles C. Thomas, 1963. 174 p.

61. FORD, K. Contraceptive efficacy among married women 15-44 years of age in the United States, 1970-73. Advance Data, No. 26, April 6, 1978. 3 p.

62. FORD, K. Use of intrauterine contraceptive devices in the United States. Advance Data, No. 43, December 12, 1978. 7 p.

63. FORREST, J.E. Postpartum services in family planning: findings to date. Reports on Population/Family Planning, No. 8, July 1971. 15 p.

64. FORTIER, L., LEFEBVRE, Y., LAROSE, M., and LANCTOT, R. Canadian experience with a copper-covered intrauterine contraceptive device. American Journal of Obstetrics and Gynecology 115(3): 291-297. February 1, 1973.

65. FRANKLIN, E.W., 3rd, ZEIDERMAN, A.M., and LAEMMLE, P. Tubal ectopic pregnancy: etiology and obstetric and gynecologic sequelae. American Journal of Obstetrics and Gynecology 117(2): 220-225. September 15, 1973.

66. FUCHS, F., CEDERQVIST, L.L., DONOVAN, S., and LAUERSEN, N.H. Comparison of the Antigon F, the copper T, and the Ypsilon IUDs. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 283-290.

67. FYLLING, P. and FAGERHOL, M. Experience with two different medicated intrauterine devices: a comparative study of the Progestasert and Nova-T. Fertility and Sterility 31(2): 138-141. February 1979.

68. GABELNICK, H. [US National Institutes of Health, Center for Population Research] [Research on IUDs] Personal communication, March 1, 1979.

69. GALLEGOS, A.J., AZNAR, R., MERINO, G., and GUIZER, E. Intrauterine devices and menstrual blood loss: a comparative study of eight devices during the first six months of use. Contraception 17(2): 153-161. February 1978.

70. GIBBS, R.S. The IUD and PID: is the contraceptive the culprit? Contemporary Ob/Gyn 11(4): 163-167. April 1978.

71. GIBOR, Y., NISSEN, C.H., and BRUNSFELD, M. Report to investigators on the Cu-7 intrauterine device: a summary of the data submitted to FDA in the New Drug Application of December 1972. (A confidential report of G.D. Searle and Company, Chicago, Illinois) 115 p.

72. GOLDITCH, I.M. and HUSTON, J.E. Serious pelvic infections associated with intrauterine contraceptive device. International Journal of Fertility 18(3): 156-160. 1973.

73. GOLDMAN, J.A. Infected ovarian cysts and the IUD. Contraception 8(6): 521-526. December 1973.

74. GOLDSMITH, A., GOLDBERG, R., EYZAGUIRRE, H., LUCERO, S., and LIZANA, L. IUD insertion in the immediate postabortal period. In: Goldsmith, A. and Snowden, R., eds. Proceedings of the Family Planning Research Conference: a multidisciplinary approach, Exeter, England, September 27-28, 1971. Amsterdam, Excerpta Medica, 1972. (International Congress Series 260) p. 59-67.

75. GRAEFENBERG, E. An intrauterine contraceptive method. In: Sanger, M. and Stone, H.M., eds. The practice of contraception: an international symposium and survey. (Proceedings of the 7th International Birth Control Conference, Zurich, Switzerland, September 1930) Baltimore, Maryland, Williams and Wilkins, 1931. p. 33-47.

76. GREWAL, S. and DAS SAIGAL, M. Experiences with IUDs in India. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 65-70.

77. GREWAL, S. and DAS SAIGAL, M. Problems arising in the introduction of IUDs in family planning programs. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 59-63.

78. GRIFFITH, A.G. [International Planned Parenthood Federation] [Distribution of IUDs] Personal communication, March 15, 1979. 4 p.

79. GUEST, F. Counseling IUD patients. Health Education Bulletin December 1978. 4 p.

80. GUILLEBAUD, J. Amount and duration of menstrual blood loss with the Progestasert IUD. [Abstract] Paper presented at the 21st British Congress of Obstetrics and Gynaecology, July 1977. p. 33.

81. GUILLEBAUD, J., ANDERSON, A.B.M., and TURNBULL, A.C. Reduction by mefenamic acid of increased menstrual blood loss associated with intrauterine contraception. British Journal of Obstetrics and Gynaecology 85(1): 53-62. January 1978.

82. GUILLEBAUD, J., BARNETT, M.D., and GORDON, Y.B. Plasma ferritin levels as an index of iron deficiency in women using intrauterine devices. British Journal of Obstetrics and Gynaecology 86(1): 51-55. January 1979.

83. GUILLEBAUD, J. and BONNAR, J. Longer though lighter menstrual and intermenstrual bleeding with copper as compared to inert intrauterine devices. British Journal of Obstetrics and Gynaecology 85(9): 707-712. September 1978.

84. GUILLEBAUD, J., BONNAR, J., MOREHEAD, J., and MATTHEWS, A. Menstrual blood-loss with intrauterine devices. Lancet 1(7956): 387-390. February 21, 1976.

85. GUPTA, H.D., BELAVALGIDAD, M.I., GUPTA, I., and DEVI, P.K. A statistical study of the copper T and copper 7 intrauterine devices. Contraception 14(6): 655-660. December 1976.

86. GUPTA, P.K., HOLLANDER, D.H., and FROST, J.K. Actinomycetes in cervico-vaginal smears: an association with IUD usage. Acta Cytologica 20(4): 295-297. July-August 1976.

87. GUPTA, P.K., MALKANI, P.K., and BHASIN, K. Cellular response in the uterine cavity after IUD insertion and structural changes of the IUD. Contraception 4(6): 375-384. December 1971.

88. GUTTORM, E. Menstrual bleeding with intrauterine contraceptive devices. Acta Obstetricia et Gynecologica Scandinavica 50: 9-16. 1971.

89. HAGENFELDT, K. and JOHANNISSON, E. The effect of intrauterine copper on the DNA-content in isolated human endometrial cells. Acta Cytologica 16(5): 472-477. September-October 1972.

90. HAGENFELDT, K. and LANDGREN, B.-M. Local effects of medicated IUDs. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 349-354.

91. HAGENFELDT, K., LANDGREN, B.-M., EDSTRÖM, K., and JOHANNISSON, E. Biochemical and morphological changes in the human endometrium induced by the Progestasert device. Contraception 16(2): 183-197. August 1977.

92. HAGER, W.D. and MAJMUDAR, B. Pelvic actinomycosis in women using intrauterine contraceptive devices. American Journal of Obstetrics and Gynecology 133(1): 60-63. January 1, 1979.

93. HALLATT, J.C.G. Ectopic pregnancy associated with the intrauterine device: a study of seventy cases. American Journal of Obstetrics and Gynecology 125(6): 754-758. July 15, 1976.

94. HALLBERG, L., HÖGDAHL, A.M., NILSSON, L., and RYBO, G. Menstrual blood loss: a population study. Acta Obstetricia et Gynecologica Scandinavica 45: 320-351. 1966.

95. HALLBERG, L. and NILSSON, L. Determination of menstrual blood loss. Scandinavian Journal of Clinical and Laboratory Investigation 16: 224-248. 1964.

96. HASPELS, A.A. [University Hospital, Utrecht, Netherlands] [Ectopic pregnancies and IUDs] Personal communication, March 22, 1979. 1 p.

97. HASSON, H.M. Copper IUDs. Journal of Reproductive Medicine 20(3): 139-154. March 1978.

98. HASSON, H.M. Factors that affect IUD performance: a review and recommendations. Journal of Reproductive Medicine 21(3): 137-145. September 1978.

99. HASSON, H.M., BERGER, G.S., and EDELMAN, D.A. Factors affecting intrauterine contraceptive device performance. American Journal of Obstetrics and Gynecology 126(8): 973-981. December 15, 1976.

100. HATCHER, R.A., STEWART, G.K., STEWART, F., GUEST, F., STRATTON, P., and WRIGHT, A.H. Contraceptive technology 1978-1979. (9th rev. ed.) New York, Irvington, 1978. 192 p.

101. HAVRÁNEK, F. and KRÁLOVÁ, A. Effect of intrauterine contraceptive device upon endometrial exfoliative cytology. Journal of Reproductive Medicine 1(6): 583-586. November-December 1968.

102. HEFNAWI, F., ASKALANI, H., and ZAKI, K. Menstrual blood loss with copper intrauterine devices. Contraception 9(2): 133-140. February 1974.

103. HEFNAWI, F., HOSNI, M., EL-SHEIKHA, Z., SEROUR, G.I., and HASSEEB, F. Perforation of the uterine wall by the Lippes Loop in postpartum women. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 469-476.

104. HEFNAWI, F., KANDIL, O., ASKALANI, A., SEROUR, G.I., ZAKI, K., NASR, F., and MOUSA, M. Mode of action of the copper IUD: effect on endometrial copper and cervical mucus sperm migration. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 459-463.

105. HEFNAWI, F., SALEH, A.A., KANDIL, O., and YACOUT, M.M. Blood loss with IUDs. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 373-380.

106. HEFNAWI, F. and SEGAL, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. 490 p.

107. HEFNAWI, F., YACOUT, M.M., HOSNI, M., EL-SHEIKA, Z., and HASSANEIN, M. Medicated intrauterine devices to improve bleeding events. International Journal of Gynaecology and Obstetrics 15(1): 79-83. 1977.

108. HELVACIOGLU, A., LONG, E.M., Jr., and YANG, S.-L. Ectopic pregnancy: an eight-year review. Journal of Reproductive Medicine 22(2): 87-92. February 1979.

109. HENDERSON, S.R. Pelvic actinomycosis associated with an intrauterine device. Obstetrics and Gynecology 41(5): 726-732. May 1973.

110. HINGORANI, V. and UMA BAI, G.R. Haemoglobin level in women with post-partum IUD insertions. Journal of Reproduction and Fertility 27(1): 119-120. October 1971.

111. HORNE, H.W., Jr. and SCOTT, J.M. Adrenosem therapy for bleeding coincident with the use of intrauterine contraceptive devices: a double blind study. Fertility and Sterility 21(3): 230-233. March 1970.

112. HUBER, S.C., PIOTROW, P.T., ORLANS, B., and KOMMER, G. IUDs reassessed: a decade of experience. Population Reports, Series B, No. 2. Washington, D.C., George Washington University Medical Center, Population Information Program, January 1975. 28 p.

113. HURT, W.G. Septic pregnancy associated with Dalkon Shield intrauterine device. Obstetrics and Gynecology 44(4): 491-495. October 1974.

114. INTERNATIONAL FERTILITY RESEARCH PROGRAM [IFRP]. A reassessment of the Lippes Loop for use by menstruating, multiparous women. Research Triangle Park, North Carolina, IFRP, [1979]. (Research Report BBX018) 28 p.

115. ISHIHAMA, A., KAGABU, T., IMAI, T., and SHIMA, M. Cytologic studies after insertion of intrauterine contraceptive devices. Acta Cytnlogica 14(1): 35-41. January 1970.

116. ISRAEL, R., SHAW, S.T. Jr., and MARTIN, M.A. Comparative quantitation of menstrual blood loss with the Lippes Loop, Dalkon Shield, and copper T intrauterine devices. Contraception 10(1): 63-71. July 1974.

117. JAFAREY, S.A., HARDEE, J.G., and SATTERTHWAITE, A.P. Use of medical-paramedical personnel and traditional midwives in the Pakistan Family Planning Program. Demography 5(2): 666-678. 1968.

118. JAIN, A.K. Comparative performance of the three types of IUDs in the United States. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 3-16.

119. JAIN, A.K. Non-medicated intrauterine devices: review and assessment. In: World Health Organization. Regulation of human fertility. (Proceedings of a Symposium on Advances in Fertility Regulation, Moscow, USSR, November 16-19, 1976) Copenhagen, Scriptor, 1977. p. 361-379.

120. JAIN, A.K. Safety and effectiveness of intrauterine devices. Contraception 11(3): 243-259. March 1975.

121. JAIN, A.K. and MOOTS, B. Fecundability following the discontinuation of IUD use among Taiwanese women. Journal of Biosocial Science 9(2): 135-151. 1977.

122. JAIN, A.K. and SIVIN, I. Life-table analysis of IUDs: problems and recommendations. Studies in Family Planning 8(2): 26-47. February 1977.

123. JECHT, E.W. and BERNSTEIN, G.S. The influence of copper on the motility of human spermatozoa. Contraception 7(5): 381-401. May 1973.

124. JENNINGS, J. Report of safety and efficacy of the Dalkon Shield and other IUDs. FDA Ad hoc Obstetric-Gynecology Advisory Committee, October 1974. 19 p. (Mimeo)

125. JOHANSSON, E.D.B. and NYGREN, K.-G. IUDs, ovarian function, and onset of menstrual bleeding. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 335-338.

126. JOHNSON, B. and VESSEY, M. Septic abortion in women using intrauterine devices. British Medical Journal 4(5991): 263-265. November 1, 1975.

127. JOSHI, S.G. Local effects of pharmacologically inert IUDs in rats, baboons, and humans. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 339-348.

128. JOSHI, S.G. and SUJAN-TEJUJA, S. Biochemistry of the human endometrium in users of the intrauterine contraceptive device. Fertility and Sterility 20(1): 98-110. 1969.

129. KAHN, H.S. and TYLER, C.W., Jr. Joint IUD study. American Medical Association, American Osteopathic Association, Center for Disease Control, PHS, DHEW. July 1973.

130. KAHN, H.S. and TYLER, C.W., Jr. Mortality associated with use of IUDs. Journal of the American Medical Association 234(1): 57-59. October 6, 1975.

131. KALLENBERGER, D.A., RONK, D.A., and JIMERSON, G.K. Ectopic pregnancy: a 15-year review of 160 cases. Southern Medical Journal 71(7): 758-763. July 1978.

132. KAMAL, I., HEFNAWI, F., GHONEIM, M., TALAAT, M., and ABDALLA, M. Dimensional and architectural disproportion between the intrauterine device and the uterine cavity: a cause of bleeding. Fertility and Sterility 22(8): 514-521. August 1971.

133. KAMAL, I., GHONEIM, M., TALAAT, M., and ABDALLA, M. Retention and expulsion of IUDs. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 359-366.

134. KATSURA, S., SATODADE, R., and MAKINO, T. Histological study of the endometrium of 459 intrauterine contraceptive device (IUD) users. Yokohama Medical Bulletin 40: 137-144. October 1969.

135. KAYE, B.M., REANEY, B.V., KAYE, D.L., and EDELMAN, D.A. Long-term safety and use-effectiveness of intrauterine devices. Fertility and Sterility 28(9): 937-942. September 1977.

136. KEITH, L., HUGHEY, M.J., and BERGER, G.S. Experience with modern inert IUDs to date: a review and comments. Journal of Reproductive Medicine 20(3): 125-132. March 1978.

137. KESSEL, E., BERNARD, R.P., and THOMAS, M.N. IUD performance and hypothesis testing in international clinical trials. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 87-113.

138. KIM-FARLEY, R.J., CATES, W., Jr., ORY, H.W., and HATCHER, R.A. Febrile spontaneous abortion and the IUD. Contraception 18(6): 561-570. December 1978.

139. KING, D.T. and LAM, M. Actinomycosis of the urinary bladder: association with an intrauterine contraceptive device. Journal of the American Medical Association 240(14): 1512-1513. September 29, 1978.

140. KOETSAWANG, S., RACHAWAT, D., and PIYA-ANANT, M. Outcome of pregnancy in the presence of intrauterine device. Acta Obstetricia et Gynecologica Scandinavica 56(5): 479-482. 1977.

141. KULLANDER, S. Experiences with an IUCD (Margulies Coil). Fertility and Sterility 21(6): 482-489. June 1970.

142. LARSSON, B. and HAMBERGER, L. Insertion of copper-7-IUDs in connection with induced abortions during first trimester. Contraception 12(1): 69-76. July 1975.

143. LARSSON, B., HAMBERGER, L., and RYBO, G. Influence of copper intrauterine contraceptive devices (Cu-7-IUD) on the menstrual blood-loss. Acta Obstetricia et Gynecologica Scandinavica 54(4): 315-318. 1975.

144. LARSSON, B., LIEDHOLM, P., and ÅSTEDT, B. Increased fibrinolytic activity in the endometrium of patients using copper-IUD (Gravigard). International Journal of Fertility 20(2): 77-80. 1975.

145. LARSSON, B., LIEDHOLM, P., SJÖBERG, N.-O., and ÅSTEDT, B. Increased fibrinolytic activity in the endometrium of patients using copper-IUD. Contraception 9(5): 531-537. March 19, 1974.

146. LAST, P.A. Pregnancy and the intrauterine contraceptive device. Contraception 9(5): 439-450. May 1974.

147. LAUFE, L.E. [International Fertility Research Program] [Research on IUDs] Personal communication, 1979.

148. LAUFE, L.E., BRICKNER, P.B., RYSER, P.E., and AMMER, J.L. An evaluation of the use-effectiveness of the Saf-T-Coil in private practice. Contraception 9(1): 23-31. January 1974.

149. LAUFE, L.E., GIBOR, Y., McCLANAHAN, B.J., and WHEELER, R.F. Volume and copper concentration of menstrual discharge from women employing copper-7 and other types of contraceptives. In: Lewit, S., ed. Advances in planned parenthood, Vol. 9. (Proceedings of the 11th Meeting of the Association of Planned Parenthood Physicians, Houston, Texas, April 12-13, 1973) Amsterdam, Excerpta Medica, 1973. p. 38-42.

150. LAUFE, L.E., WHEELER, R., and FRIEL, P. Modification of IUDs for postpartum use. .To be published in Lancet)

151. LEDGER, W.J. Relationship of pelvic infection to various types of contraception. Clinical Obstetrics and Gynecology 17(1): 79-91. March 1974.

152. LEHFELDT, H., TIETZE, C., and GORSTEIN, F. Ovarian pregnancy and the intrauterine device. American Journal of Obstetrics and Gynecology 108(7): 1005-1009. December 1, 1970.

153. LERIDON, H. Les pratiques contraceptives en France (1978). [Contraceptive practice in France (1978)] [FR] Population et Sociétés, No. 120, January 1979. 4 p.

154. LEVINSON, C.J. and RICHARDSON, D.C. The Dalkon Shield story. Advances in Planned Parenthood 11(2): 53-63. 1976.

155. LEWIT, S. Outcome of pregnancy with intrauterine devices. Contraception 2(1): 47-57. July 1970.

156. LIEDHOLM, P. RYBO, G., SJÖBERG, N.-O., and SOLVELL, L. Copper IUD: influence on menstrual blood loss and iron deficiency. Contraception 12(3): 317-325. September 1975.

157. LIEDHOLM, P., SJÖBERG, N.-O., and ÅSTEDT, B. Increased bleeding and fibrinolytic activity in the endometrium in women using the copper T. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 391-395.

158. LIPPES, J. Infection and the IUD: a preliminary report. Contraception 12(1): 103-106. July 1975.

159. LIPPES, J. Management of the lost IUD: a conservative approach. In: Sciarra, J.J., Zatuchni, G.I., and Speidel, J.J., eds. Risks, benefits, and controversies in fertility control. [Proceedings of the workshop, Arlington, Virginia, March 13-16, 1977] Hagerstown, Maryland, Harper and Row, 1978. p. 404-407.

160. LIPPES, J. PID-IUD association needs more study. [Letter] Contemporary Ob/Gyn 11(5): 13. May 1978.

161. LIPPES, L. A study of intra-uterine contraception: development of a plastic loop. In: Tietze, C. and Lewit, S., eds. Intra-uterine contraceptive devices. (Proceedings of the Conference, New York, April 30-May 1, 1962) Amsterdam, Excerpta Medica, [1962]. (International Congress Series 54) p. 69-75.

162. LIPPES, J., MALIK, T., and TATUM, H.J. The post-coital copper-T. Advances in Planned Parenthood 11(1): 24-29. 1976.

163. LIPPES, J. and ZIELEZNY, M. The loop after ten years. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 225-236.

164. LIUKKO, O., ERKKOLA, R., and LAAKSON, L. Ectopic pregnancies during use of low-dose progestogens for oral contraception. Contraception 16(6): 575-580. December 1977.

165. LOGHMANI, M. and MITRA, M. Evaluation of trained midwives in a copper-T IUD insertion program in Isfahan, Iran. International Journal of Gynaecology and Obstetrics 14(3): 205-207. 1976.

166. LUUKKAINEN, T., NIELSEN, N.-C., NYGREN, K.-G., PYÖRÄLÄ, T., and ALLONEN, H. Combined and national experience of postmenstrual IUD insertions of Nova-T and copper-T in a randomized study. Contraception 19(1): 11-20. January 1979.

167. LUUKKAINEN, T., NIELSEN, N.-C., NYGREN, K.-G., PYÖRÄLÄ, T., and KOSONEN, A. Randomized comparison of clinical performance of two copper-releasing IUDs, Nova-T and copper-T-200, in Denmark, Finland and Sweden. Contraception 19(1): 1-9. January 1979.

168. LUUKKAINEN, T. and NILSSON, C.G. Sustained intrauterine release of d-norgestrel. Contraception 18(4): 451-458. October 1978.

169. LUUKKAINEN, T., TIMONEN, H., and SIVIN, I. Multiclinic copper T studies in Finland. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 243-248.

170. MacMATH, I.F. Antifibrinolytic control of menorrhagia after I.U.D. insertion. Practitioner 210: 417-420. March 1973.

171. MALMQVIST, R., PETERSOHN, L., and BENGTSSON, L.P. Menstrual bleeding with copper-covered intrauterine contraceptive devices. Contraception 9(6): 627-633. June 1974.

172. MARTIN, P.M. and BROWN, J.B. The effect of intrauterine contraceptive devices on ovarian and menstrual function in the human. Journal of Clinical Endocrinology and Metabolism 36(6): 1125-1131. June 1973.

173. MARTINEZ-MANAUTOU, J., AZNAR, R., ROSADO, A., and MAQUEO, M. Clinical experience with the intrauterine progesterone-releasing systems. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 173-184.

174. MAYES, D.G. A comparison of menstrual bleeding patterns associated with three IUD models: an example of reference period analysis. Journal of Biosocial Science 9(1): 121-135. January 1977.

175. MAYES, D.G. Factors in menstrual bleeding patterns. Paper presented at the Exeter Workshop, University of Exeter, 1976.

176. MISHELL, D.R., Jr. Assessing the intrauterine device. Family Planning Perspectives 7(3): 103-111. May-June 1975.

177. MISHELL, D.R., Jr. The clinic factor in evaluating IUDs. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 27-36.

178. MISHELL, D.R., Jr. Current status of contraceptive steroids and the intrauterine device. Clinical Obstetrics and Gynecology 17(1): 35-51. March 1974.

179. MISHELL, D.R., Jr. Historical considerations in the development of modern IUDs: patient and device selections and the importance of insertion techniques. Journal of Reproductive Medicine 20(3): 121-124. March 1978.

180. MISHELL, D.R., Jr. New frontiers of contraception. Journal of Reproductive Medicine 21(5, Suppl.): 256. November 1978.

181. MISHELL, D.R., Jr. Pregnancy related complications and bleeding problems with IUDs. In: Sciarra, J.J., Zatuchni, G.I., and Speidel, J.J., eds. Risks, benefits, and controversies in fertility control. [Proceedings of the workshop, Arlington, Virginia, March 13-16, 1977] Hagerstown, Maryland, Harper and Row, 1978. p. 428-434.

182. MISHELL, D.R., Jr., ISRAEL, R., and FREID, N. A study of the copper T intrauterine contraceptive device (TCu 200) in nulliparous women. American Journal of Obstetrics and Gynecology 116(8): 1092-1096. August 15, 1978.

183. MISHELL, D.R., Jr. and MOYER, D.L. Association of pelvic inflammatory disease with the intrauterine device. Clinical Obstetrics and Gynecology 12: 179-197. 1969.

184. MOOTS, B.L. Factors affecting the impact of IUDs on fertility control. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 71-86.

185. MOO-YOUNG, A.J., TATUM, H.J., WAN, L.S., and LANE, M.E. Copper levels in certain tissues of rhesus monkeys and of women bearing copper IUDs. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 439-457.

186. MOREHEAD, J.E., MATTHEWS, A., GUILLEBAUD, J., and BONNAR, J. Menstrual blood loss in users of an IUD. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 381-390.

187. MORROW, P. [Program for the Introduction and Adaptation of Contraceptive Technology] [Research on IUDs] Personal communication, March 1979.

188. MOYER, D.L. and MISHELL, D.R., Jr. Reactions of human endometrium to the intrauterine foreign body. 2. Long-term effects on the endometrial histology and cytology. American Journal of Obstetrics and Gynecology 111(1): 66-80. September 1, 1971.

189. MOYER, D.L. and SHAW, S.T., Jr. Intrauterine device: biological action. In: Hafez, E.S.E. and Evans, T.N., eds. Human reproduction: conception and contraception. Hagerstown, Maryland, Harper and Row, 1973. p. 309-334.

190. MURAMATSU, M. Family planning and contraception. In: Population Problems Research Council and the Mainichi Newspapers. Summary of Fourteenth National Survey on Family Planning. Tokyo, Mainichi Newspapers, [1978]. p. 51-89.

191. NASH, H. [Population Council] [TCu 380] Personal communication, March 5, 1979. 1 p.

192. NEWTON, J., ELIAS, J., McEWAN, J., and MANN, G. Evaluation of the copper 7 in England. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 291-302.

193. NILSSON, C.G. Comparative quantitation of menstrual blood loss with a d-norgestrel-releasing IUD and a Nova-T-copper device. Contraception 15(4): 379-387. April 1977.

194. NILSSON, C.G., JOHANSSON, E.D.B., JACKANICZ, T.M., and LUUKKAINEN, T. Biodegradable polylactate as a steroid-releasing polymer: intrauterine administration of d-norgestrel. American Journal of Obstetrics and Gynecology 122(1): 90-95. May 1, 1975.

195. NILSSON, C.G., JOHANSSON, E.D.B., and LUUKKAINEN, T. A d-norgestrel releasing IUD. Contraception 13(4): 503-514. April 1976.

196. NILSSON, C.G. and LUUKKAINEN, T. Improvement of a d-norgestrel-releasing IUD. Contraception 15(3): 295-306. March 1977.

197. NILSSON, L. and RYBO, G. Treatment of menorrhagia. American Journal of Obstetrics and Gynecology 110(5): 713-720. July 1, 1971.

198. NILSSON, L. and RYBO, G. Treatment of menorrhagia with an antifibrinolytic agent, tranexamic acid (AMCA): a double-blind investigation. Acta Obstetricia et Gynecologica Scandinavica 46: 572-580. 1967.

199. NILSSON, L. and RYBO, G. Treatment of menorrhagia with epsilon amino-caproic acid. Acta Obstetricia et Gynecologica Scandinavica 44: 467-473. 1965.

200. NORTMAN, D. Changing contraceptive patterns: a global perspective. Population Bulletin 32(3): 1-37. August 1977.

201. NORTMAN, D.L. and HOFSTATTER, E. Population and family planning programs: a factbook. (5th ed.) Reports on Population/Family Planning, No. 2, September 1973. 95 p.

202. NORTMAN, D.L. and HOFSTATTER, E. Population and family planning programs: a factbook. (6th ed.) Reports on Population/Family Planning, No. 2, December 1974. 95 p.

203. NORTMAN, D.L. and HOFSTATTER, E. Population and family planning programs. (9th ed.) New York, Population Council, 1978. 92 p.

204. NORTMAN, D.L. and HOFSTATTER, E. Population and family planning programs: a factbook. (10th ed.) New York, Population Council. (In press)

205. NYGREN, K.-G. and JOHANSSON, E.D.B. Postabortion insertion of the intrauterine copper T (TCu 200). In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 115-118.

206. ORLANS, F.B. Copper IUDs: performance to date. Population Reports, Series B, No. 1. Washington D.C., George Washington University Medical Center, Population Information Program, December 1973. 20 p.

207. ORY, H.W. A review of the association between intrauterine devices and acute pelvic inflammatory disease. Journal of Reproductive Medicine 20(4): 200-204. April 1978.

208. OSTER, G.K. Chemical reactions of the copper intrauterine device. Fertility and Sterility 23(1): 18-23. January 1972.

209. OSTER, G. and SALGO, M.P. The copper intrauterine device and its mode of action. New England Journal of Medicine 293(9): 432-438. August 28, 1975.

210. OTA, T. A study on the birth control with an intrauterine instrument. Japanese Journal of Obstetrics and Gynecology 17: 210-214. 1934.

211. PARK, C.B., CHO, L.-J., and PALMORE, J.A. The Euiryong experiment: a Korean innovation in household contraceptive distribution. Studies in Family Planning 8(3): 67-76. March 1977.

212. PARK, C.B., CHO, L.J., and PALMORE, J.A. Household contraceptive distribution: preliminary results for Euiryong, Korea. In: Gardner, J.S., Wolff, R.J., Gillespie, D., and Duncan, G.W., eds. Village and household availability of contraceptives: Southeast Asia, 1976. Seattle, Washington, Battelle Memorial Institute, Human Affairs Research Centers, June 1976. p. 31-54.

213. PASTENE, L., RIVERA, M., ZIPPER, J., MEDEL, M., and THOMAS, M. IUD insertions by midwives: five years' experience in Santiago, Chile. International Journal of Gynecology and Obstetrics 15(1): 84-87. July-August 1977.

214. PATHAK, U.N. and STEWART, D.B. Autotransfusion in ruptured ectopic pregnancy. Lancet 1(7654): 961-964. May 9, 1970.

215. PERLMUTTER, J.F. Pregnancy and the IUD. Journal of Reproductive Medicine 20(3): 133-137. March 1978.

216. PHAOSAVASDI, S., VIVANICHAKUL, B., RIENPRAYURA, D., CHUTIVONGSE, S. VIRUTAMASEN, P., and SNIDVONGS, W. Pelvic inflammatory disease in contraceptive acceptors disclosed at transvaginal tubal sterilization. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 397-399.

217. PHARRISS, B.B. [Alza Corporation] [Alza Corporation research on IUDs] Personal communication, March 13, 1979. 2 p.

218. PHARRISS, B.B. Clinical experience with the intrauterine progesterone contraceptive system. Journal of Reproductive Medicine 20(3): 155-165. March 1978.

219. PHARRISS, B.B. Uterine progesterone system. In: Wheeler, R.G., Duncan, G.W., and Speidel, J.J., eds. Intrauterine devices: development, evaluation, and program implementation. [Proceedings of a Workshop on Advances in IUDs, Battelle Seattle Research Center, Seattle, Washington, October 18-20, 1973] New York, Academic Press, 1974. p. 203-210.

220. PHARRISS, B.B., ERICKSON, R., BASHAW, J., HOFF, S., PLACE, V.A., and ZAFFARONI, A. Progestasert: a uterine therapeutic system for long-term contraception. 1. Philosophy and clinical efficacy. Fertility and Sterility 25(11): 915-921. November 1974.

221. PHATAK, L. and CHANDORKAR, K. Experience with immediate post-partum and post-abortal IUD insertions and disappearance of IUD threads. In: Zatuchni, G.I., ed. Post-partum family planning: a report on the international program. New York, McGraw-Hill, 1970. p. 295-306.

222. PORTER, C.W., Jr. and WAIFE, R.S. Intrauterine devices: current perspectives. Chestnut Hills, Massachusetts, Pathfinder Fund, 1978. 62 p.

223. POTTS, M. [International Fertility Research Program] [IUD research] Personal communication, 1979.

224. POTTS, M. Newsletter to IFRP contributors and friends. Research Triangle Park, North Carolina, December 12, 1978. 2 p. (Mimeo)

225. POTTS, M., SPEIDEL, J.J., and KESSEL, E. Relative risks of various means of fertility control when used in less developed countries. In: Sciarra, J.J., Zatuchni, G.I., and Speidel, J.J., eds. Risks, benefits, and controversies in fertility control. [Proceedings of the workshop, Arlington, Virginia, March 13-16, 1977] Hagerstown, Maryland, Harper and Row, 1978. p. 404-407.

226. PRESTON, E.J., ERVIN, D.K., McMICHAEL, A.O., and PRESTON, L.W. Septic spontaneous abortion associated with the Dalkon Shield. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 417-428.

227. PUST, K. Ein brauchbarer Frauenschutz. [A useful protection for women] [GE] Deutsche Medizinische Wochenschrift 49(29): 952-953. July 20, 1923.

228. RAGAB, M.I. and THOMAS, M.N. The use of tranexamic acid (AMCA) in IUDs as an anti-bleeding agent. International Journal of Gynaecology and Obstetrics 14(2): 137-141. 1976.

229. RAMASWAMY, S. and SMITH, T. Intrauterine devices. In: Ramaswamy, S. and Smith, T. Practical contraception. Tunbridge Wells, England, Pitman Medical, 1976. p. 57-74.

230. RAMOS, R. and APELO, R.A. A program of IUD insertions by paraprofessionals and physicians in the Philippines. International Journal of Obstetrics and Gynaecology 16(4): 321-323. January-February 1979.

231. RANTAKYLÄ, P., YLÖSTALO, P., JÄRVINEN, P.A., and VUORJOKI, A. Ectopic pregnancies and the use of intrauterine device and low dose progestogen contraception. Acta Obstetricia et Gynecologica Scandinavica 56(1): 61-62. 1977.

232. RATNAM, S.S. and YIN, J.C.K. Translocation of Lippes Loop (the missing loop). British Medical Journal 1(5592): 612-614. March 9, 1968.

233. RAVENHOLT, R.T. [Family planning in China] Personal communication, November 28, 1978.

234. RICHTER, R. Ein Mittel zur Verhutung der Konzeption. [A means of preventing pregnancy] [GE] Deutsche Medizinische Wochenschrift 35: 1525-1527. 1909.

235. RINEHART, W. and PIOTROW, P.T. OCs: update on usage, safety, and side effects. Population Reports, Series A, No. 5. Baltimore, Maryland, Johns Hopkins University, Population Information Program, January 1979. 55 p.

236. ROBLES, F., LOPEZ de la OSA, E., LERNER, U., JOHANNISSON, E., BRENNER, P., HAGENFELDT, K., and DICZFALUSY, E. α-Amylase, glycogen synthetase and phosphorylase in the human endometrium: influence of the cycle and of the Cu-T device. Contraception 6(5): 373-384. November 1972.

237. RODRIGUEZ, G., FAUNDES-LATHAM, A., and ATKINSON, L.E. An approach to the analysis of menstrual patterns in the critical evaluation of contraceptives. Studies in Family Planning 7(2): 42-51. February 1976.

238. ROSENFIELD, A.G. Family planning: an expanded role for paramedical personnel. American Journal of Obstetrics and Gynecology 110(7): 1030-1039. August 1, 1971.

239. ROSENFIELD, A.G. The IUD in national family planning programs: programmatic issues. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 37-45.

240. ROSENFIELD, A.G. and CASTADOT, R.G. Early postpartum and immediate postabortion intrauterine contraceptive device insertion. American Journal of Obstetrics and Gynecology 118(8): 1104-1114. April 15, 1974.

241. ROSS, J.A. and KWON, H.Y. Post-abortal immediate IUD insertion: further experience and a controlled comparison of three devices. Contraception 17(3): 237-252. March 1978.

242. ROWE, P.J. [World Health Organization] [Research on IUDs] Personal communication, March 21, 1979.

243. ROWE, P.J., KOETSAWANG, S., PIZARRO, E., and DIETHELM, P. Comparative bleeding patterns of a progesterone-releasing IUD. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 185-198.

244. RUDEL, H.W., KINCL, F.A., and HENZL, M.R., eds. Birth control, contraception, and abortion. New York, MacMillan, 1973. 372 p.

245. RYBO, G. The IUD and endometrial bleeding. Journal of Reproductive Medicine 20(3): 175-182. March 1978.

246. RYBO, G. and BERGQVIST, A. Comparison of menstrual blood loss with the Progestasert system and the Cu-T-200: preliminary results. In: Mishell, D.R., Jr. and Martinez-Manautou, J., eds. Proceedings of a Symposium on Clinical Experience with the Progesterone Uterine Therapeutic System, Acapulco, Mexico, October 15-16, 1976. Princeton, New Jersey, Excerpta Medica, 1978. p. 106-110.

247. RYDER, N.B. Contraceptive failure in the United States. Family Planning Perspectives 5(3): 133-142. Summer 1973.

248. RYDER, N.B. Time series of pill and IUD use: United States, 1961-1970. Studies in Family Planning 10(3): 233-240. October 1972.

249. SAĞIROĞLU, N. Local effects of polyethylene IUDs in women: mode of action, a synthetic vaccine, and a macrophagic immunity. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 465-468.

250. SAĞIROĞLU, N. Phagocytosis of spermatozoa in the uterine cavity of woman using intrauterine device. International Journal of Fertility 16(1): 1-14. January-March 1971.

251. SAĞIROĞLU, N. and SAĞIROĞLU, E. The cytology of intrauterine devices. Acta Cytologica 14: 58-64. 1970.

252. SATTAR, M.A. The status and trends of family planning programmes in developing countries: a case study of Bangladesh. [Statement, April 27, 1978] In: United States. Congress. House of Representatives. Select Committee on Population. Population and development: status and trends of family planning/population programs in developing countries. Vol. 2. Hearings, April 25-27, 1978. Washington, D.C., U.S. Government Printing Office, 1978. p. 630-640.

253. SAVOLAINEN, E. and SAIKSELA, E. Ectopic pregnancy: relationship to the preceding contraception. Annales Chirurgiae et Gynaecologiae 67: 198-202. 1978.

254. SCHIFFER, M.A., ELGUEZABAL, A., and ALLEN, A.C. Actinomycosis infection associated with intrauterine contraceptive device and a vaginal pessary. Advances in Planned Parenthood 7(4): 183-193. 1978.

255. SCHMIDT, F. [Population Council] [Pregnancies subsequent to use of copper T devices] Personal communication, March 1979.

256. SCHNEIDER, J., BERGER, C.J., and CATTELL, C. Maternal mortality due to ectopic pregnancy: a review of 102 deaths. Obstetrics and Gynecology 49(5): 557-561. May 1977.

257. SCHOEN, J.A. and NOWAK, J.R. Repeat ectopic pregnancy: a 16-year clinical survey. Obstetrics and Gynecology 45(5): 542-546. May 1975.

258. SCOMMEGNA, A. Medicated IUDs: an improvement? In: Sciarra, J.J., Zatuchni, G.I., and Speidel, J.J., eds. Risks, benefits, and controversies in fertility control. [Proceedings of the workshop, Arlington, Virginia, March 13-16, 1977] Hagerstown, Maryland, Harper and Row, 1978. p. 459-466.

259. SCOMMEGNA, A., AVILA, T., LUNA, M., RAO, R., and DMOWSKI, W.P. Fertility control by intrauterine release of progesterone. Obstetrics and Gynecology 43(5): 769-779. May 1974.

260. SCOMMEGNA, A., PANDYA, G.N., CHRIST, M., LEE, A.W., and COHEN, M.R. Intrauterine administration of progesterone by a slow releasing device. Fertility and Sterility 21(3): 201-210. March 1970.

261. SCUTCHFIELD, F.D. and LONG, W.N. Perforation of the uterus with the Lippes Loop: epidemiologic analysis. Journal of the American Medical Association 208(12): 2335-2336. June 23, 1969.

262. SEGAL, S.J. Diary notes on trip to China: Peking, September 24, 1977. (Unpublished) 2 p.

263. SEGAL, S.J. and NORDBERG, O.S. Fertility regulation technology: status and prospects. Population Bulletin 31(6): 1-25. March 1977.

264. SEGAL, S.J., SOUTHAM, A.L., and SHAFER, K.D. Intra-uterine contraception. (Proceedings of the 2nd International Conference, New York, October 2-3, 1964) Amsterdam, Excerpta Medica, 1965. (International Congress Series 86) 250 p.

265. SEGAL, S.J. and TIETZE, C. Contraceptive technology: current and prospective methods. Reports on Population/Family Planning, No. 1, July 1971. p. 1-24.

266. SHAILA, N.G., LANE, M.E., and SOBRERO, A.J. A comparative randomized double-blind study of the copper-T 200 and copper-7 intrauterine contraceptive devices with modified insertion techniques. American Journal of Obstetrics and Gynecology 120(1): 110-116. September 1, 1974.

267. SHAW, S.T., Jr. and MOYER, D.L. Problem bleeding with IUDs. In: Wheeler, R.G., Duncan, G.W., and Speidel, J.J., eds. Intrauterine devices: development, evaluation, and program implementation. [Proceedings of a Workshop on Advances in IUDs, Battelle Seattle Research Center, Seattle, Washington, October 18-20, 1973] New York, Academic Press, 1974. p. 99-103.

268. SHINE, R.M. and THOMPSON, J.F. The in situ IUD and pregnancy outcome. American Journal of Obstetrics and Gynecology 119(1): 124-130. May 1, 1974.

269. SIDDALL, R.S. The intrauterine contraceptive pessary: inefficient and dangerous. American Journal of Obstetrics and Gynecology 8(1): 76-79. July 1924.

270. SIEGLER, A.M. and KEMMANN, E. Location and removal of misplaced or embedded intrauterine devices by hysteroscopy. Journal of Reproductive Medicine 16(3): 139-144. March 1976.

271. SIVIN, I. [Population Council] [Analysis of IUD research results] Personal communication. March 1, 1979.

272. SIVIN, I. Contraception and fertility change in the international postpartum program. New York, Population Council, 1974. 98 p.

273. SIVIN, I. Copper T IUD use and ectopic pregnancy rates in the United States. Contraception 19(2): 151-173. February 1979.

274. SIVIN, I. Effect of calcium deposition on copper IUDs. [Letter] British Medical Journal 2(6083): 387. August 6, 1977.

275. SIVIN, I. The effectiveness of the copper-T intrauterine device: a collaborative study in five countries. Studies in Family Planning 4(7): 162-170. July 1973.

276. SIVIN, I. Standards for measurement and reporting life table IUD rates to minimize bias. Paper presented at FDA Conception Control Sub-Committee, Panel on Review of Obstetrical and Gynecological Devices, Washington, D.C., March 15-16, 1976. 21 p.

277. SIVIN, I. Two years of experience with the copper T (TCu 200): a study in four developing countries. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 249-282.

278. SIVIN, I. and STERN, J. Long-acting and more effective copper T devices. Studies in Family Planning. (In press)

279. SMITH, H.M., SMITH, W.I., and EDWARDS, S.J. The detection of intrauterine contraceptive devices by ultrasonic investigation. Radiology 43(507): 60-62. March 1977.

280. SMITH, M.R. and SODERSTROM, R. Salpingitis: a frequent response to intrauterine contraception. Journal of Reproductive Medicine 16(4): 159-162. April 1976.

281. SMITH, M., VESSEY, M.P., BOUNDS, W., and WARREN, J. Progestogen-only oral contraception and ectopic gestation. British Medical Journal 4(5936): 104-105. October 12, 1974.

282. SNOWDEN, R. Pelvic inflammation, perforation, and pregnancy outcome associated with the use of IUDS. Paper presented at the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974. 6 p.

283. SNOWDEN, R. The Progestasert and ectopic pregnancy. [Letter] British Medical Journal 2(6102): 1600-1601. December 17, 1977.

284. SNOWDEN, R. The statistical analysis of menstrual bleeding patterns. Journal of Biosocial Science 9(1): 107-120. January 1977.

285. SNOWDEN, R., WILLIAMS, M., and HAWKINS, D. The IUD: a practical guide. London, Croom Helm, 1977. 113 p.

286. SOBRERO, A.J. Intrauterine devices in clinical practice. Family Planning Perspectives 3(1): 16-24. January 1971.

287. SODERSTROM, R.M. The wandering IUD: what to do? In: Sciarra, J.J., Zatuchni, G.I., and Speidel, J.J., eds. Risks, benefits, and controversies in fertility control. (Proceedings of the workshop, Arlington, Virginia, March 13-16, 1977) Hagerstown, Maryland, Harper and Row, 1978. p. 408-412.

288. SOMBOONSUK, A., CHIAWCHARNWIT, T., ONTHUAM, Y., CHAUDHURY, R.R., FUCHS, F., and GROSSMAN, R. Randomized comparative trial of three IUDs in rural Thailand: preliminary report of first 12-month follow-up. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 199-204.

289. SOMBOONSUK, A. and ROSENFIELD, A.G. Experiences with the Lippes Loop 1965-1971. International Journal of Gynaecology and Obstetrics 11(1): 16-24. January 1973.

290. SOUTHAM, A.L. Historical review of intra-uterine devices. In: Segal, S.J., Southam, A.L., and Shaffer, K.D., eds. Intra-uterine contraception. (Proceedings of the 2nd International Conference, New York, October 2-3, 1964) New York, Excerpta Medica, 1965. (International Congress Series 86) p. 3-5.

291. SPARKS, R.A., BUCKINGHAM, M.S., ELSTEIN, M., WATT, P.J., and PURRIER, B.G.A. Maternal death and the I.U.D. [Letter] Lancet 1(8002): 98. January 8, 1977.

292. SPARKS, R.A. and LETCHWORTH, A.T. Mid-trimester septic abortion and Escherichia coli septicaemia in a copper IUCD user. British Medical Journal 1(6111): 481-482. February 25, 1978.

293. SPEIDEL, J.J. [US Agency for International Development] [Program assistance] Personal communication, March 1979.

294. SPEIDEL, J.J. [US Agency for International Development] [Research on IUDs] Personal communication, December 1978.

295. SPEIDEL, J.J., KESSEL, E., BERGER, G.S., and LABBOK, M. Recent developments in technology for the control of female fertility. Obstetrics and Gynecology Annual 7: 397-445. 1978.

296. SPEIDEL, J.J. and RAVENHOLT, R.T. The role of IUDs in developing countries. In: Wheeler, R.G., Duncan, G.W., and Speidel, J.J., eds. Intrauterine devices: development, evaluation, and program implementation [Proceedings of a Workshop on Advances in IUDs, Battelle Seattle Research Center, Seattle, Washington, October 18-20, 1973] New York, Academic Press, 1974. p. 1-31.

297. SPENCE, M.R., GUPTA, P.K., FROST, J.K., and KING, T.M. Cytologic detection and clinical significance of Actinomyces israelii in women using intrauterine contraceptive devices. American Journal of Obstetrics and Gynecology 131(3): 295-298. June 1, 1978.

298. STADEL, B. [US National Institutes of Health, Center for Population Research] [Research on IUDs] Personal communication, March 1, 1979.

299. STATHAM, R. and MORTON, R.S. Gonorrhoea and the intrauterine contraceptive device. British Medical Journal 4(5631): 623-625. December 7, 1968.

300. STEVEN, J.D. and FRASER, I.S. The outcome of pregnancy after failure of an intrauterine contraceptive device. Journal of Obstetrics and Gynaecology of the British Commonwealth 81: 282-284. April 1974.

301. STEWART, D.B. Autotransfusion in ruptured tubal ectopic pregnancy. In: Purandare, B.N. and Jhaveri, C.L., eds. Proceedings of the International Seminar on Maternal Mortality, Family Planning and Biology of Reproduction, held at Bombay on 3rd to 8th March 1969. Bombay, India, Federation of Obstetric and Gynaecological Societies of India, [1970]. p. 65-66.

302. STEWART, W.C., GIBOR, Y., DEYSACH, L., and NISSEN, C. Clinical studies with the Cu 7: a comparison of results in parous and nulliparous women. In: International Planned Parenthood Federation [IPPF]. Clinical Proceedings, Southeast Asia at Oceania Congress, Sydney, 1972. London, IPPF, 1973. p. 211-214.

303. STEWART, W.C., O'BRIEN, F., NISSEN, C., and DEYSACH, L. Multiclinic evaluation of Gravigard (Cu 7) intrauterine contraception. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 149-153.

304. SWEDISH INTERNATIONAL DEVELOPMENT AUTHORITY. [IUD distribution] Personal communication, March 22, 1979. 1 p.

305. TAMADA, T., OKAGAKI, T., MARUYAMA, M., and MATSUMOTO, S. Endometrial histology associated with an intrauterine contraceptive device. American Journal of Obstetrics and Gynecology 98(6): 811-817. July 15, 1967.

306. TAMAYO, F. The Colombian experience: a statement to the Congress of the United States. [Statement, April 25, 1978] In: United States. Congress. House of Representatives. Select Committee on Population. Population and development: status and trends of family planning/population programs in developing countries. Vol. 2. Hearings, April 25-27, 1978. Washington, D.C., U.S. Government Printing Office, 1978. p. 299-312.

307. TARGUM, S.D. and WRIGHT, N.H. Association of the intrauterine device and pelvic inflammatory disease: a retrospective pilot study. American Journal of Epidemiology 100(4): 262-271. October 1974.

308. TATUM, H.J. Clinical aspects of intrauterine contraception: circumspection 1976. Fertility and Sterility 28(1): 3-28. January 1977.

309. TATUM, H.J. Comparative experience with newer models of the copper T in the United States. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 155-163.

310. TATUM, H.J. Intrauterine contraception. American Journal of Obstetrics and Gynecology 112(7): 1001-1023. April 1, 1972.

311. TATUM, H.J., HATCHER, R.A., MISHELL, D.R., Jr., SCOMMEGNA, A., and ZIPPER, J.A. Which IUD should you prescribe? Contemporary Ob/Gyn 11(4): 126 ff. April 1978.

312. TATUM, H.J. and SCHMIDT, F.H. Contraceptive and sterilization practices and extrauterine pregnancy: a realistic perspective. Fertility and Sterility 28(4): 407-421. April 1977.

313. TATUM, H.J., SCHMIDT, F.H., and JAIN, A.K. Management and outcome of pregnancies associated with the copper T intrauterine contraceptive device. American Journal of Obstetrics and Gynecology 126(7): 869-879. December 1, 1976.

314. TATUM, H.J., SCHMIDT, F.H., and PHILLIPS, D.M. Morphological studies of Dalkon Shield tails removed from patients. Contraception 11(4): 465-477. April 1975.

315. TATUM, H.J., SCHMIDT, F.H., PHILLIPS, D., McCARTY, M., and O'LEARY, W.M. The Dalkon Shield controversy: structural and bacteriological studies of IUD tails. Journal of the American Medical Association 231(7): 711-717. February 17, 1975.

316. TATUM, H.J., SCHMIDT, F.H., PHILLIPS, D., McCARTY, M., and O'LEARY, W.M. Microbial migration in the thread attached to an IUD as a possible factor in infectious complications. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 411-415.

317. TATUM, H.J. and ZIPPER, J.A. The "T" intrauterine contraceptive device and recent advances in hormonal anticonceptional therapy. Paper presented at the 6th Northeast Obstetrics-Gynecology Congress, Bahia, Brazil, October 4-9, 1968. 6 p.

318. TAUBER, P.F., WOLF, A.S., HERTING, W., and ZANEVELD, L.J.D. Hemorrhage induced by intrauterine devices: control by local proteinase inhibition. Fertility and Sterility 28(12): 1375-1377. December 1977.

319. TEJUJA, S., CHOUDHURY, S.D., MALHOTRA, U., and SAXENA, N.C. Clinical trial with the copper 7 intrauterine device: one year experience in India. Contraception 10(4): 351-360. October 1974.

320. TEJUJA, S., SAXENA, N.C., MALHOTRA, U., and CHOUDHURY, S.D. Experience with the copper T in India. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 165-171.

321. THEIRY, M., VAN DER PAS, H.M., VAN OS, W.A.A., TAUBER, P.F., DOMBROWICZ, N., McDONALD, J.S., HASPELS, A.A., DROGENDIJK, A.C., VAN KETS, H., and BOOGERS, W. Three years experience with the MLCu 250, a new copper wired intrauterine contraceptive device. Advances in Planned Parenthood 13(3-4): 35-40. 1978.

322. TIETZE, C. Contraception with intrauterine devices: 1959-1966. American Journal of Obstetrics and Gynecology 96(7): 1043-1054. December 1, 1966.

323. TIETZE, C. and LEWIT, S. Evaluation of intrauterine devices: ninth progress report of the Cooperative Statistical Program. Studies in Family Planning 55: 1-40. July 1970.

324. TIETZE, C. and LEWIT, S., eds. Intra-uterine contraceptive devices. (Proceedings of the Conference, New York, April 30-May 1, 1962) Amsterdam, Excerpta Medica, [1962]. (International Congress Series 54) 200 p.

325. TIMONEN, H. and LUUKKAINEN, T. Immediate postabortion insertion of the copper-T (TCu-200) with eighteen months follow-up. Contraception 9(2): 153-160. February 1974.

326. TIMONEN, H. and LUUKKAINEN, T. The use-effectiveness of the copper-T-200 in a simulated field trial. Contraception 9(1): 1-13. January 1974.

327. TYLER, C.W., Jr. and KAHN, H.S. Morbidity and mortality associated with use of IUDs in the United States and Puerto Rico. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 47-57.

328. UNITED NATIONS FUND FOR POPULATION ACTIVITIES [UNFPA]. Inventory of population projects in developing countries around the world 1976/77. New York, UNFPA, [1978]. 687 p.

329. UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT [USAID]. OFFICE OF POPULATION. Family planning service statistics, annual report, 1976. Washington, D.C., USAID, 1977. 150 p.

330. UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT [USAID]. OFFICE OF POPULATION. Family planning program statistics by quarter: 1977. Washington, D.C., USAID, [1977]. 28 p. (Mimeo)

331. UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT. OFFICE OF POPULATION. [IUD deliveries] Personal communication, 1979. 3 p.

332. UNITED STATES DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE. CENTER FOR DISEASE CONTROL. IUD safety: report of a nationwide physician survey. Morbidity and Mortality Weekly Report 23(26): 226, 231. June 29, 1974.

333. UNITED STATES DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE. FOOD AND DRUG ADMINISTRATION. Intrauterine contraceptive devices; professional and patient labeling. Federal Register 42(90): 23772-23783. May 10, 1977.

334. UNITED STATES DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE. FOOD AND DRUG ADMINISTRATION. Progestasert IUD and ectopic pregnancy. FDA Drug Bulletin 8(6): 37. December 1978-January 1979.

335. UNITED STATES DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE. FOOD AND DRUG ADMINISTRATION. Statement of policy concerning new drug states of certain intrauterine devices. Federal Register 38(44): 6137. March 7, 1973.

336. UNITED STATES DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE. FOOD AND DRUG ADMINISTRATION. ADVISORY COMMITTEE ON OBSTETRICS AND GYNECOLOGY. Report on intrauterine contraceptive devices. Washington, D.C., U.S. Government Printing Office, 1968. 101 p.

337. UNITED STATES DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE. FOOD AND DRUG ADMINISTRATION. MEDICAL DEVICE AND DRUG ADVISORY COMMITTEES ON OBSTETRICS AND GYNECOLOGY. Second report on intrauterine contraceptive devices. Washington, D.C., U.S. Government Printing Office, December 1978. 102 p.

338. UNITED STATES NATIONAL INSTITUTES OF HEALTH. CENTER FOR POPULATION RESEARCH. Ten year progress report. Rockville, Maryland, Center for Population Research, November 1978.

339. VAN IDDEKINGE, B. Ectopic pregnancy: a review. South African Medical Journal 46: 1844-1849. November 2, 1972.

340. VAUGHAN, B., TRUSSELL, J., MENKEN, J., and JONES, E.F. National Center for Health Statistics: contraceptive efficacy among married women, 1970-73. (To be published in PHS 1000-Series 23)

341. VESSEY, M., DOLL, R., PETO, R., JOHNSON, B., and WIGGINS, P. A long-term follow-up study of women using different methods of contraception: an interim report. Journal of Biosocial Science 8(4): 373-427. October 1976.

342. VESSEY, M.P., JOHNSON, B., DOLL, R., and PETO, R. Outcome of pregnancy in women using an intrauterine device. Lancet 1(7856): 495-498. March 23, 1974.

343. VESSEY, M.P., WRIGHT, N.H., McPHERSON, K., and WIGGINS, P. Fertility after stopping different methods of contraception. British Medical Journal 1(6108): 265-267. February 4, 1978.

344. VIECHNICKI, M.B. Septicemia and abortion with the CU-7. American Journal of Obstetrics and Gynecology 127(2): 203. January 15, 1977.

345. VIEL, B. and LUCERO, S. An analysis of 3 years' experience with intrauterine devices among women in the western area of the city of Santiago, July 1, 1964, to June 30, 1967. American Journal of Obstetrics and Gynecology 106(5): 765-775. March 1, 1970.

346. VIRKAR, K. and PARULKAR, N. Pregnancies and intrauterine devices with special reference to the outcome of pregnancies and the fate of the devices. Journal of Obstetrics and Gynaecology of India 24(4): 332-340. August 1974.

347. WAGATSUMA, T. Clinical experience with the Progestasert intrauterine progesterone contraceptive system in Asia. In: Mishell, D.R., Jr. and Martinez-Manautou, J., eds. Proceedings of a Symposium on Clinical Experience with the Progesterone Uterine Therapeutic System, Acapulco, Mexico, October 15-16, 1976. Princeton, New Jersey, Excerpta Medica, 1978. p. 91-95.

348. WAGATSUMA, T., SAKAMOTO, S., MATSUYAMA, E., AMENOMORI, Y., KOBAYASHI, T., TAKADA, M., MATSUDA, S., FUJIMOTO, S., SHIMIZU, T., SUZUKI, M., ISHIHAMA, A., NAKANISHI, T., SUNOUCHI, S., and SEKIBA, K. A study on the contraceptive effectiveness of a newly designed IUD "FD-1" in Japan. Contraception 17(1): 41-49. January 1978.

349. WAN, L.S., HSU, Y.-C., GANGULY, M., and BICELOW, B. Effects of the Progestasert on the menstrual pattern, ovarian steroids and endometrium. Contraception 16(4): 417-433. October 1977.

350. WEEKES, A.R.L. and HUTCHINS, C.J. Ectopic pregnancy: a five year review. British Journal of Clinical Practice 30(5): 104-106. May 1976.

351. WEEKES, A.R.L. and SUTHERST, J.R. Ectopic pregnancy and the I.U.D. [Letter] Lancet 2(7945): 1144. December 6, 1975.

352. WEI, P.Y. Downward displacement of IUDs and related problems of accidental pregnancy and cervical penetration. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 367-371.

353. WEI, P.Y. Occurrence of ectopic pregnancy in women with IUD's and consideration of the contraceptive mechanism of the IUD. American Journal of Obstetrics and Gynecology 101(6): 776-778. July 15, 1968.

354. WELANDER, M. [AB Kabi, Stockholm, Sweden] [Copper T marketing] Personal communication, March 6, 1979. 1 p.

355. WESTRÖM, L. [University Hospital, Lund, Sweden] [Ectopic pregnancy] Personal communication, April 2, 1979.

356. WESTRÖM, L. Effect of acute pelvic inflammatory disease on fertility. American Journal of Obstetrics and Gynecology 121(5): 707-713. March 1, 1975.

357. WESTRÖM, L. and BENGTSSON, L.P. Effect of tranexamic acid (AMCA) in menorrhagia with intrauterine contraceptive devices: a

double-blind study. Journal of Reproductive Medicine 5(4): 41-48. October 1970.

358. WESTRÖM, L., BENGTSSON, L.P., and MÅRDH, P.A. The risk of pelvic inflammatory disease in women using intrauterine contraceptive devices as compared to non-users. Lancet 2(7979): 221-224. July 31, 1976.

359. WHEELER, R.G. [International Fertility Research Program] [Research on IUDs] Personal communication, March 1, 1979.

360. WHEELER, R.G., BUSCHBOM, R.L., and MARSHALL, R.K. A rational basis for IUD design and development. In: Wheeler, R.G., Duncan, G.W., and Speidel, J.J., eds. Intrauterine devices: development, evaluation, and program implementation. [Proceedings of a Workshop on Advances in IUDs, Battelle Seattle Research Center, Seattle, Washington, October 18-20, 1973] New York, Academic Press, 1974. p. 163-184.

361. WHEELER, R.G., DUNCAN, G.W., and SPEIDEL, J.J., eds. Intrauterine devices: development, evaluation, and program implementation. [Proceedings of a Workshop on Advances in IUDs, Battelle Seattle Research Center, Seattle, Washington, October 18-20, 1973] New York, Academic Press, 1974. 260 p.

362. WHELAN, E.M. Attitudes toward menstruation. Studies in Family Planning 6(4): 106-108. April 1975.

363. WHITE, M.K., ORY, H.W., ROOKS, J.B., and ROCHAT, R.W. Intrauterine device termination rates and the menstrual cycle day of insertion. Atlanta, Georgia, Center for Disease Control. 18 p. (Unpublished)

364. WHITE, M.K., ROOKS, J.B., STRAUSS, L., ROCHAT, R.W., TYLER, C.W., Jr., and SENANAYAKE, P. Current practice concerning time of IUD insertion. IPPF Medical Bulletin 11(6): 1-3. December 1977.

365. WILLIAMS, P., JOHNSON, B., and VESSEY, M. Septic abortion in women using intrauterine devices. British Medical Journal 4(5991): 263-264. November 1, 1975.

366. WILSON, E.W. The effect of copper on lactic dehydrogenase isoenzymes in human endometrium. Contraception 16(4): 367-375. October 1977.

367. WORLD HEALTH ORGANIZATION [WHO]. Intrauterine devices: physiological and clinical aspects. Geneva, WHO, 1968. (Technical Report Series 397) 32 p.

368. WORLD HEALTH ORGANIZATION [WHO]. Seventh annual report. Geneva, WHO, 1978. 167 p.

369. WRIGHT, N.H. and LAEMMLE, P. Acute pelvic inflammatory disease in an indigent population: an estimate of its incidence and relationship to methods of contraception. American Journal of Obstetrics and Gynecology 101(7): 979-990. August 1, 1968.

370. WRIGHT, N.H., SUJPLUEM, C., ROSENFIELD, A.G., and VARAKAMIN, S. Nurse-midwife insertion of the copper T in Thailand: performance, acceptance, and programmatic effects. Studies in Family Planning 8(9): 237-243. September 1977.

371. WRIGHT, N.H., SUVANAVEJH, C., KLINCHOM, P., and VARAKAMIN, S. Copper T-200: combined Bangkok hospital clinical evaluation. Contraception 10(3): 231-240. September 1974.

372. WYNN, R.M. and SAWARAGI, I. Effects of intra-uterine and oral contraceptives on the ultrastructure of the human endometrium. Journal of Reproduction and Fertility (Suppl. 8): 45-57. 1969.

373. ZADOR, G., NILSSON, B.A., NILSSON, B., SJÖBERG, N.-O., WESTRÖM, L., and WIESE, J. Clinical experience with the uterine progesterone system (Progestasert). Contraception 13(5): 559-569. May 1976.

374. ZATUCHNI, G.I. Overview of program: two-year experience. In: Zatuchni, G.I., ed. Post-partum family planning: a report on the international program. New York, McGraw-Hill, 1970. p. 30-88.

375. ZEIGHAMI, E., ZEIGHAMI, B., EFTEKHARI, A.E., and KHOSHNEVIS, P. Effectiveness of the Iranian auxiliary midwife in IUD insertion. Studies in Family Planning 7(9): 261-263. September 1976.

376. ZIPPER, J. Chilean experience with IUDs: updating the program. In: Hefnawi, F. and Segal, S.J., eds. Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 217-224.

377. ZIPPER, J., EDELMAN, D.A., and GOLDSMITH, A. An overview of IUD research and implications for the future. International Journal of Gynaecology and Obstetrics 15(1): 73-78. 1977.

378. ZIPPER, J., MEDEL, M., GOLDSMITH, A., and EDELMAN, D.A. Six-year continuation rates for Cu-T-200 users. Journal of Reproductive Medicine 18(2): 95-97. February 1977.

379. ZIPPER, J., MEDEL, M., OSORIO, A., GOLDSCHMITH, A., and EDELMAN, D.A. Long-term use effectiveness of the Cu-T-200 IUD. International Journal of Gynaecology and Obstetrics 14(2): 142-144. 1976.

380. ZIPPER, J., MEDEL, M., PASTENE, L., RIVERA, M., and TATUM, H.J. Human fertility control through the use of endouterine metal antagonisms of trace elements (EMATE). In: Diczfalusy, E. and Borell, U., eds. Control of human fertility. (Proceedings of the 15th Nobel Symposium, Södergarn, Lidingö, Sweden, May 27-29, 1970) New York, John Wiley and Sons, 1971. p. 199-218.

381. ZIPPER, J., MEDEL, M., PASTENE, L., RIVERA, M., TORRES, L., OSORIO, A., and TOSCANINI, C. Four years experience with the Cu7 200 device: endouterine copper in fertility control. Contraception 13(1): 7-15. January 1976.

382. ZIPPER, J., MEDEL, M., AND PRAGER, R. Suppression of fertility by intrauterine copper and zinc in rabbits: a new approach to intrauterine contraception. American Journal of Obstetrics and Gynecology 105(4): 529-534. October 15, 1969.

383. ZIPPER, J.A., TATUM, H.J., PASTENE, L., MEDEL, M., and RIVERA, M. Metallic copper as an intrauterine contraceptive adjunct to the "T" device. American Journal of Obstetrics and Gynecology 105(8): 1274-1278. December 15, 1969.

ADDENDA

384. BENGTSSON, L.P. and MOAWAD, A.H. The effect of the Lippes Loop on human myometrial activity. American Journal of Obstetrics and Gynecology 98(7): 957-965. August 1, 1967.

385. EISINGER, S.H. Second-trimester spontaneous abortion, the IUD, and infection. American Journal of Obstetrics and Gynecology 124(4): 393-397. February 1976.

386. GÓMEZ-ROGERS, C., IBARRA POLO, A.A., FAUNDES, A., and GUILOFF, E. Effect of the IUD and other contraceptive methods on lactation. In: Hankinson, R.K.B., Kleinman, R.L., and Eckstein, P., eds. Proceedings of the 8th International Conference of the International Planned Parenthood Federation, Santiago, Chile, April 9-15, 1967. London, International Planned Parenthood Federation, December 1967. p. 328-334.

387. GUILLEBAUD, J. Location of "lost" IUDs. [Letter] British Journal of Family Planning 3: 43-44. 1977.

388. GUILLEBAUD, J. and KASONDE, J.M. A simple scheme for managing the problem of "lost threads" with intrauterine devices. (To be published in Fertility and Conception)

389.HEFNAWI, F., KANDIL, O., HAMDI, M., BADRAOUI, H., EL-GAALI, O., ABDEL-KADER, M.M., TALAAT, M., AZIZ, A., and BAHGAT, R. Effect of inert IUDs on lactation. In: Hefnawi, F. and Segal, S.J., eds., Analysis of intrauterine contraception. (Proceedings of the 3rd International Conference on Intrauterine Contraception, Cairo, Egypt, December 12-14, 1974) Amsterdam, North-Holland, 1975. p. 431-438.

390. HINGORANI, V. and UMA BAI, G.R. Lactation and lactational amenorrhoea with *post-partum* IUCD insertions. Journal of Reproduction and Fertility 23(3): 513-515. December 1970.

391. HORN, H., FINKELSTEIN, M., BEN-DAVID, M., SALZBERGER, M., CHOWERS, I., BEN-ASSULY, S., and BELL, J. Possible effect of intrauterine device on galactorrhea in women. Contraception 12(4): 419-424. October 1975.

392. JONAS, G. Ectopic pregnancy despite intrauterine contraception: a clue to mode of action of I.U.C.D.s. British Medical Journal 3(5981): 467. August 23, 1975.

393. KOSONEN, A. [Outokumpu Oy, Pori, Finland] [Availability and design of Nova T] Personal communication, March 30, 1979. 2 p.

394. KOSONEN, A. Corrosion of copper in utero. Fertility and Sterility 30(1): 59-65. July 1978.

395. MEHTA, S., PAWAR, V., JOSHI, J., KORA, S., RAJANI, U., VIRKAR, K.D., RAIKAR, R.S., and SHETH, A.R. Serum prolactin levels in women using copper IUDs. Contraception 15(3): 327-334. March 1977.

396. OSTERIA, T.S. The effects of contraception upon lactation: analysis of urban data. [1976] 18 p. (Unpublished)

397. SHAPIRO, A.G. Management of the lost intrauterine contraceptive device. Obstetrics and Gynecology 49(2): 238-240. February 1977.

398. SPELLACY, W.N. and BUHI, W.C. A prospective study of plasma prolactin levels in women using the progesterone releasing intrauterine device (P-IUD). Contraception 19(1): 91-94. January 1979.

399. WENOF, M., AUBERT, J.M., and REYNIAK, J.V. Serum prolactin levels in short-term and long-term use of inert plastic and copper intrauterine devices. Contraception 19(1): 21-27. January 1979.

400. WORLD HEALTH ORGANIZATION. SPECIAL PROGRAMME OF RESEARCH, DEVELOPMENT AND RESEARCH TRAINING IN HUMAN REPRODUCTION. An assessment of the Lippes Loop D and the Copper T 220C. HRP/79.1 Rev. 1. April 1979. 4 p.

CHANGE OF ADDRESS FORM

Please send *Population Reports* to my new address:

Name

Street

City, State, Zip Code

County

(Attach old label here or write in old address.)

POPINFORM
Literature Search Request

POPINFORM, a computerized literature search service, contains published and unpublished information on all aspects of family planning and population—oral contraceptives, intrauterine devices, male and female sterilization, pregnancy termination, prostaglandins, barrier methods of contraception, periodic abstinence, experimental methods of fertility control, population law and policy, demography, and the design, management, and evaluation of family planning programs. Worldwide in coverage and continually updated, the POPINFORM data base consists of more than 50,000 citations to family planning and population literature with index terms and, in most cases, abstracts. Documents in all languages are collected; citations and abstracts are online in English.

POPINFORM'S data base is provided by the Population Information Program, the Center for Population and Family Health (a division of the International Institute for the Study of Human Reproduction) at Columbia University, and the Family Planning Evaluation Division of the US Center for Disease Control in Atlanta. Computer searches of the data base are available free of charge to population professionals—researchers, clinicians, program administrators, population officers, and policy makers—in developing countries. The service is particularly useful to those working in areas distant from large urban centers and research facilities. In the USA, POPINFORM is available online by subscription.

A request for a POPINFORM literature search, submitted on this request form, will be filled promptly. Copies of the cited articles that are difficult to obtain also will be supplied upon request.

Please define your subject as specifically as possible (for example, the prevalence of oral contraceptive use in Japan since 1973). Include, where appropriate, the purpose of the literature search (for example, research, or preparation of a paper), time period to be covered (for example, information produced in 1975–1976), and geographic limitation (for example, Latin America only).

NAME (Please print): _____

TITLE: _____

ORGANIZATION: _____

ADDRESS: _____

_____

_____

SEARCH TOPIC: _____

_____

_____

_____

PURPOSE: _____

_____

Requests should be sent to:

POPINFORM
Population Information Program
The Johns Hopkins University
624 North Broadway
Baltimore, Maryland 21205
USA

or

LIBRARY
Center for Population and Family Health
International Institute for the Study of Human Reproduction
Columbia University
60 Haven Avenue
New York, New York 10032
USA

BEST AVAILABLE COPY

PUBLICATIONS OF THE POPULATION INFORMATION PROGRAM

ORAL CONTRACEPTIVES — Series A

- _____A-1, Oral Contraceptives — 50 Million Users *(F, P, S)*
- _____A-2, Advantages of Orals Outweigh Disadvantages *(A, F, P, S)*
- _____A-3, Minipill — A Limited Alternative for Certain Women *(F, P, S)*
- _____A-4, Debate on Oral Contraceptives and Neoplasia Continues; Answers Remain Elusive *(F, S)*
- _____Supplement to A-4 (Charts and Tables) *(F, S)*
- _____A-5, OCs — Update on Usage, Safety, and Side Effects

INTRAUTERINE DEVICES — Series B

- _____B-1, Copper IUDs — Performance to Date *(F, P, S)*
- _____B-2, IUDs Reassessed — A Decade of Experience *(F, P, S)*
- _____B-3, IUDs — Update on Safety, Effectiveness, and Research

STERILIZATION, Female — Series C

- _____C-1, Laparoscopic Sterilization — A New Technique *(F, P, S)*
- _____C-2, Laparoscopic Sterilization II: What Are the Problems? *(F, P, S)*
- _____C-3, Colpotomy — The Vaginal Approach *(F, P, S)*
- _____C-4, Laparoscopic Sterilization with Clips *(F, P, S)*
- _____C-5, Female Sterilization by Mini-Laparotomy *(A, F, P, S)*
- _____C-6, Female Sterilization Using the Culdoscope *(F, P, S)*
- _____C-7, Tubal Sterilization — Review of Methods *(F, S)*

STERILIZATION, Male — Series D

- _____D-1, Vasectomy — Old & New Techniques *(F, P, S)*
- _____D-2, Vasectomy — What Are the Problems? *(F, P, S)*
- _____D-3, Vasectomy Reversibility — A Status Report *(F, P)*

LAW AND POLICY — Series E

- _____E-1, Eighteen Months of Legal Change *(F, S)*
- _____E-2, World Plan of Action & Health Strategy Approved
- _____E-3, Abortion Law & Practice — A Status Report *(F, S)*
- _____E-4, Recent Law and Policy Changes in Fertility Control *(F, P, S)*
- _____E-5, The 29th Day *(F, P, S)*

PREGNANCY TERMINATION — Series F

- _____F-1, Five Largest Countries Allow Legal Abortion on Broad Grounds *(F, P, S)*
- _____F-2, Menstrual Regulation — What Is It? *(F, P, S)*
- _____F-3, Uterine Aspiration Techniques *(F, P, S)*
- _____F-4, Menstrual Regulation Update *(F, P, S)*
- _____F-5, Pregnancy Termination in Midtrimester — Review of Major Methods *(F, S)*
- _____F-6, Cervical Dilatation — A Review

PROSTAGLANDINS — Series G

- _____G-1, Clinical Use of PGs in Fertility Control *(F, S)*
- _____G-2, Fertility Control Research Maps & Directory *(F, S)*
- _____G-3, A Review: Modulation of Autonomic Transmission by Prostaglandins *(F, S)*
- _____G-4, "Prostaglandin Impact" for Menstrual Induction *(F)*
- _____G-5, Physiology and Pharmacology of PGs in Parturition
- _____G-6, Prostaglandins Promise More Effective Fertility Control
- _____G-7, Clinical Use of Prostaglandins for Pregnancy Termination

BARRIER METHODS — Series H

- _____H-1, Condom — An Old Method Meets a New Social Need *(F, P, S)*
- _____H-2, The Modern Condom — A Quality Product for Effective Contraception *(F, P, S)*
- _____H-3, Vaginal Contraceptives — Reappraisal *(F, P, S)*
- _____H-4, Diaphragm & Other Intravaginal Barriers *(F, P, S)*

PERIODIC ABSTINENCE — Series I

- _____I-1, Birth Control without Contraceptives *(F, P, S)*
- _____I-2, Sex Preselection — Not Yet Practical

FAMILY PLANNING PROGRAMS — Series J

- _____J-1, Family Planning Programs & Fertility Patterns *(F, P, S)*
- _____J-2, World Fertility Trends, 1974 *(F, S)*
- _____J-3, Advanced Training in Fertility Management *(F, P, S)*
- _____J-4, Breast-feeding — Aid to Infant Health & Fertility Control *(F, P, S)*
- _____J-5, Contraceptive Distribution — Taking Supplies to Villages and Households *(F, P, S)*
- _____J-6, Training Nonphysicians in Family Planning Services & a Directory of Training Programs *(F, P, S)*
- _____J-7, Pregnancy Tests — The Current Status *(F, P, S)*
- _____J-8, Effects of Childbearing on Maternal Health *(F, P, S)*
- _____J-9, Postcoital Contraception — An Appraisal *(F, P, S)*
- _____J-10, Adolescent Fertility — Risks and Consequences *(F, P, S)*
- _____J-11, Twenty-two Dimensions of the Population Problem *(F, P, S)*
- _____J-12, World Fertility, 1976: An Analysis of Data Sources and Trends *(F)*
- _____J-13, World Population Trends: Signs of Hope, Signs of Stress *(F, P)*
- _____J-14, Health: The Family Planning Factor *(A, F, S)*
- _____J-15, A Guide to Sources of Family Planning Program Assistance *(F, S)*
- _____J-16, Media Communications in Population/Family Planning Programs: A Review (F, P, S)
- _____J-17, Service Statistics: Aid to More Effective FP Program Management
- _____J-18, The Population Crisis in Latin America *(P and S only)*
- _____J-19, Community-Based and Commercial Contraceptive Distribution
- _____J-20, Filling Family Planning Gaps (F, P, S)

INJECTABLES AND IMPLANTS — Series K

- _____K-1, Injectable Progestogens — Officials Debate but Use Increases *(F, P, S)*

ISSUES IN WORLD HEALTH — Series L

- _____L-1, Tobacco — Hazards to Health and Human Reproduction

SPECIAL TOPICS — Series M

- _____M-1, M/F Sterilization Equipment Guide
- _____M-2, Voluntary Sterilization: World's Leading Contraceptive Method *(F, P, S)*

INDEX

- _____Index 1972-1977 (to English edition only)

Copies are available to health personnel in developing countries. All publications are in English. Many are available in Arabic, French, Portuguese, and Spanish as indicated after each title. Check preferred language: Arabic ☐, English ☐, French ☐, Portuguese ☐, Spanish ☐. Indicate number of copies desired and mail to:

Population Information Program
The Johns Hopkins University
624 North Broadway, Baltimore, Maryland 21205, USA

(Please Print or Type All Information)

Name _____
Address _____
City _____ Zip _____
Country _____
Organizational Affiliation _____

☐ Please add my name to the **Population Reports** mailing list.
☐ I am already on the **Population Reports** mailing list.
☐ Please send me a **Population Reports** binder.
☐ I do not want to receive **Population Reports** regularly.